

7.

## *Wonders of Light - Part II*



*The water on the road is actually an optical illusion called mirage.*

**Q.I (A) Choose the correct alternatives and rewrite the complete sentences :**

- \*1. The phenomenon of splitting of light into its component colours is .....
- (a) reflection (b) refraction  
(c) dispersion (d) rectilinear propagation
- \*2. Very fine particles mainly scatter ..... light.
- (a) red (b) green  
(c) blue (d) yellow
- \*3. The phenomenon of change in the ..... of light when it passes from one transparent medium to another is refraction.
- (a) Wavelength (b) frequency  
(c) direction (d) amplitude
- \*4. The refractive index depends upon the ..... of propagation of light in different media.
- (a) relative speed (b) density of medium  
(c) amplitude (d) frequency
5. The ratio  $\frac{\sin i}{\sin r}$  = constant is called as .....
- (a) dispersion (b) spectrum  
(c) refractive index (d) proportionality constant
6. The apparent random wavering of hot air above the heated roads causes a phenomenon called as .....
- (a) looming (b) mirage  
(c) spectrum (d) dispersion
7. The refractive index of water is .....
- (a) 1.33 (b) 1.31  
(c) 1.36 (d) 1
8. The refractive index of ..... is the highest.
- (a) alcohol (b) flint glass  
(c) diamond (d) canada balsam
9. When a ray of light travels from an optically denser medium to an optically rarer medium, the ray bends .....
- (a) towards the normal (b) away from the normal  
(c) straight (d) backwards
10. After dispersion ..... colour deviates the most.
- (a) red (b) green  
(c) yellow (d) violet
11. When white light is dispersed into seven colours ..... colour bends least.
- (a) blue (b) violet  
(c) red (d) yellow
12. .... light is scattered the least by the atmosphere.
- (a) Red (b) Violet  
(c) Yellow (d) Green
13. .... was the first scientist to use a glass prism to obtain the spectrum of sunlight.
- (a) Oersted (b) Joule  
(c) Newton (d) Faraday
14. The apparent depth of an object placed in a denser medium and seen through a rarer medium is .....
- (a) half its real depth (b) equal to the real depth  
(c) less than real depth (d) greater than real depth

15. A prism is a transparent medium bound by ..... plane surfaces inclined at an angle.  
(a) two (b) three  
(c) four (d) one
16. When a ray of light passes from rarer medium to a denser medium, the angle of refraction is .....  
(a) equal to angle of incidence  
(b) independent of angle of incidence  
(c) smaller than angle of incidence  
(d) greater than angle of incidence
17. The apparent position of a star in the sky is .....  
(a) slightly lower than its actual position  
(b) slightly higher than its actual position  
(c) same as that of its actual position  
(d) far away from its actual position
18. Advanced sunlight and delayed sunset increases duration of day by ..... minutes.  
(a) 30 (b) 4  
(c) 1 (d) 10
19. Amongst the following ..... has the highest refractive index.  
(a) air (b) ice  
(c) water (d) alcohol
20. When a ray is incident normal to the interface between any two transparent medium, the angle of incidence is .....  
(a) greater than angle of refraction (b) zero  
(c) less than angle of refraction (d)  $45^\circ$
21. The stars are ..... sources of light as they are very far away.  
(a) point (b) infinite  
(c) important (d) primary
22. Twinkling of stars is due to change in ..... of atmosphere  
(a) temperature (b) refractive index  
(c) pressure (d) climate
23. .... won a nobel prize for his outstanding work on scattering of light.  
(a) Newton (b) Joule  
(c) Dr. C. V. Raman (d) Ohm

**Answers :**

- |  |                                      |
|--|--------------------------------------|
| 1. dispersion                                | 2. blue                              |
| 3. direction                                 | 4. relative speed                    |
| 5. refractive index                          | 6. mirage                            |
| 7. 1.36                                      | 8. diamond                           |
| 9. away from the normal                      | 10. violet                           |
| 11. red                                      | 12. Red                              |
| 13. Newton                                   | 14. less than real depth             |
| 15. two                                      | 16. smaller than angle of incidence. |
| 17. slightly higher than its actual position | 18. 4                                |
| 19. alcohol                                  | 20. greater than angle of refraction |
| 21. point                                    | 22. refractive index                 |
| 23. Dr. C. V. Raman                          |                                      |

**Q.I (B) Match the following :****1. Column I**

- (i) Air
- (ii) Water
- (iii) Alcohol
- (iv) Diamond

**Column II**

- (a) 1.44
- (b) 1.0003
- (c) 1.36
- (d) 1.31
- (e) 2.42

**Ans.** (i - b), (ii - c), (iii - a), (iv - e).

**2. Column I**

- (i) Refraction
- (ii) Refractive index
- (iii) Absolute refractive index
- (iv) Dispersion

**Column II**

- (a) With respect to vacuum
- (b) Change in direction of light
- (c) Spectrum
- (d)  $\frac{\sin i}{\sin r}$
- (e) Mirage

**Ans.** (i - b), (ii - d), (iii - a), (iv - c).

**\*3. Column I**

- (i) Dispersion
- (ii) Scattering
- (iii) Refraction

**Column II**

- (a) Change in the direction of ray of light due to change in medium
- (b) Splitting of white light into component colours
- (c) Deflection of light by small particles

**Column III**

- 1. Blue colour of the sky
- 2. Twinkling of stars
- 3. Spectrum of seven colours

**Ans.** (i - b, 3), (ii - c, 1), (iii - a, 2).

**Q.I (C) State whether the following statements are true or false. If false write the corrected statement :**

- 1. When the atmosphere refracts more light towards us, the star is seen dim.

**Ans. False.** When the atmosphere refracts more light towards us, the star is seen bright.

- 2. The hotter air is rarer than the cooler air.

**Ans. True.**

- 3. During dispersion red colour deviates the most.

**Ans. False.** During dispersion violet colour deviates the most.

- 4. Refractive index of blue colour is less than orange colour.

**Ans. True.**

- 5. In the visible range of light, maximum scattering of blue light and least scattering of red light takes place.

**Ans. True.**

- 6. Spectrum of light was first observed by Albert Einstein.

**Ans. False.** Spectrum of light was first observed by Sir Issac Newton.

- 7. Velocity of light is greater in rarer medium than denser.

**Ans. True.**

- 8. Greater is the value of refractive index, the more is bending of refracted ray towards normal.

**Ans. True.**

9. The greater is the value of refractive index, the lesser is the bending of refracted ray towards the normal.

**Ans. False.** The greater is the value of refractive index, the greater is the bending of refracted ray towards the normal.

10. Red colour is scattered in a greater amount than blue and violet colour.

**Ans. False.** Blue and violet colour are scattered in a greater amount than red colour.

11. Speed of light is different in different media.

**Ans. True.**

**Q.I (D) Find the odd man out :**

1. Reflection, Dispersion, Refractive index, Refraction.

**Ans. Refractive index.** Refractive index is a value while the rest are natural phenomenon of light.

2. Brown, Blue, Green, Red.

**Ans. Brown.** It is not the component of white light. Blue, red and green are components of white light.

3. Twinkling of stars, Advanced sunrise, Delayed sunset, Blue sky.

**Ans. Blue sky.** This is because of scattering of light, while the others are due to atmospheric refraction.

4. Dispersion, Mirage, Refraction, Induction.

**Ans. Induction.** It is related to electric current, while others are phenomena of light.

**Q.II Define the following :**

**1. Refraction.**

**Ans.** The phenomenon of change in the direction of light when it passes from one transparent medium to another is called refraction.

**2. Refractive index.**

**Ans.** For a given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant. This constant is called as refractive index.

If 'i' is the angle of incidence and 'r' is the angle of refraction then,

$$\frac{\sin i}{\sin r} = \text{Constant.}$$

**3. Dispersion of light.**

**Ans.** The phenomenon of splitting of light into its component colours is dispersion.

**4. Spectrum.**

**Ans.** The band of coloured components of a light beam is called its spectrum.

**5. Scattering of light.**

**Ans.** When a ray of light is incident on extremely small particles, the particles deflect the light in different directions. This phenomenon is scattering of light.

**6. Absolute refractive index.**

**Ans.** If medium first is vacuum then refractive index of medium second is called as absolute refractive index.

**Q.III (A) Give scientific reasons :****\*1. The sky appears dark instead of blue to a person located in space.**

- Ans.**
1. The blue colour of the sky is due to scattering of light by the atmosphere.
  2. At higher altitudes there is no atmosphere hence, the scattering of light does not take place at all. Hence in space the sky appears dark instead of blue.

**\*2. Stars twinkle at night.**

- Ans.**
1. Stars are point sources of light as they are very far away.
  2. The refractive index of air in the given region in atmosphere goes on changing continuously and randomly.
  3. When the atmosphere refracts more light towards us, the star is seen bright.
  4. When the atmosphere refracts less light towards us, the star is seen dim.
  5. Thus, due to change in refractive index of atmosphere, stars appear twinkling at night.

**\*3. The sun appears reddish early in morning.**

- Ans.**
1. At the time of sunrise or sunset, the sun is very close to horizon.
  2. Sunlight has to travel a longer path through the atmosphere to reach the observer.
  3. The blue and violet colours are scattered in a greater amount than red colour.
  4. The light that reaches to the observer is mostly red and yellow. Hence the sun appears reddish early in the morning.

**\*4. It is possible to enjoy a rainbow at fountains in any season.**

- Ans.**
1. The rainbow appears in the sky after a rain shower.
  2. The water droplets act as small prism.
  3. When sunlight enters the water droplets present in the atmosphere, they refract and disperse the incident sunlight, then they reflect it internally and finally again refract resulting in a rainbow.
  4. The water droplets of a fountain can do the same thing if sunlight passes through them. Hence it is possible to enjoy a rainbow at fountains in any season.

**5. Planets do not twinkle.**

- Ans.**
1. As compared to stars, planets are nearer to the earth.
  2. So a planet can be considered as a collection of a large number of point sources of light.
  3. If the intensity of light from one point source decreases, it increases from the other source. Hence average intensity remains the same. Hence planets don't twinkle.

**6. During holi, we see flickering of an object through a turbulent stream of hot air rising above the fire of holi.**

- Ans.**
1. The air just above the fire become hotter than the air further up.
  2. The hotter air is lighter (rarer) than the cooler air (denser) above it. Hence the refractive index of hotter air is less than cooler air.
  3. As the physical conditions of air are not stationary, when we observe, the apparent position of object fluctuates. Hence during holi, we see flickering on an object behind the fire.

**\*7. Red colour is used in danger signals.**

- Ans.**
1. In the visible range of light, maximum scattering of blue light and least scattering of red light takes place.
  2. As red light is scattered the least by atmosphere. It can travel larger distance.
  3. Hence danger signals are red coloured.

**8. A coin immersed in water or bottom of a swimming pool appears raised.**

- Ans.**
1. When light travels from denser (water) to rarer (air) medium it bends away from the normal.
  2. Due to this, it appears to come from a point above the actual point.
  3. Hence, a coin immersed in water or bottom of a swimming pool appears raised.

**Q.III (B) Answer the following questions in short :**

**1. State the laws of refraction.**

- Ans.**
1. The incident ray and the refracted ray are on the opposite sides of the normal at the point of incidence and all three lie in the same plane.
  2. For a given pair of media, the ratio of the sine of the angle of incidence to the sine of the angle of refraction is constant.
- If 'i' is the angle of incidence and 'r' is angle of refraction then,

$$\frac{\sin i}{\sin r} = \text{Constant.}$$

**2. How are rainbows formed ?**

- Ans.**
1. The rainbow appears in the sky after a rain shower.
  2. The water droplets act as small prism.
  3. When sunlight enters the water droplets present in the atmosphere, they refract and disperse the incident sunlight. Then they reflect it internally inside the droplet and finally again refract it.
  4. As a collective effect of all these phenomena the seven coloured rainbow is formed.

**\*3. What do you mean by dispersion ? Name the different colours of light in the proper sequence in the spectrum of light.**

- Ans.**
1. The phenomenon of splitting of light into its component colours is called as dispersion.
  2. The band of coloured components of light beam is called as spectrum. The colours in the order from bottom to top are violet, indigo, blue, green, yellow, orange, red (VIBGYOR).

**\*4. What is refraction of light ? How it is related to refractive index ?**

- Ans.**
1. The phenomenon of change in the direction of light when it passes from one transparent medium to another is called refraction.
  2. The extent of change in the direction of the light ray is different for different media and is related to the refractive index of the medium.

**Q.IV (A) Distinguish between :**

**1. Refraction and Dispersion.**

<b>Refraction</b>	<b>Dispersion</b>
1. The phenomenon of change in the direction of light when it passes from one transparent medium to another is called refraction.	1. The phenomenon of splitting of light into its component colours is dispersion.
2. It occurs when light passes between any two transparent medium.	2. It occurs when light passes through a prism.

**2. Dispersion of light and Scattering of light.**

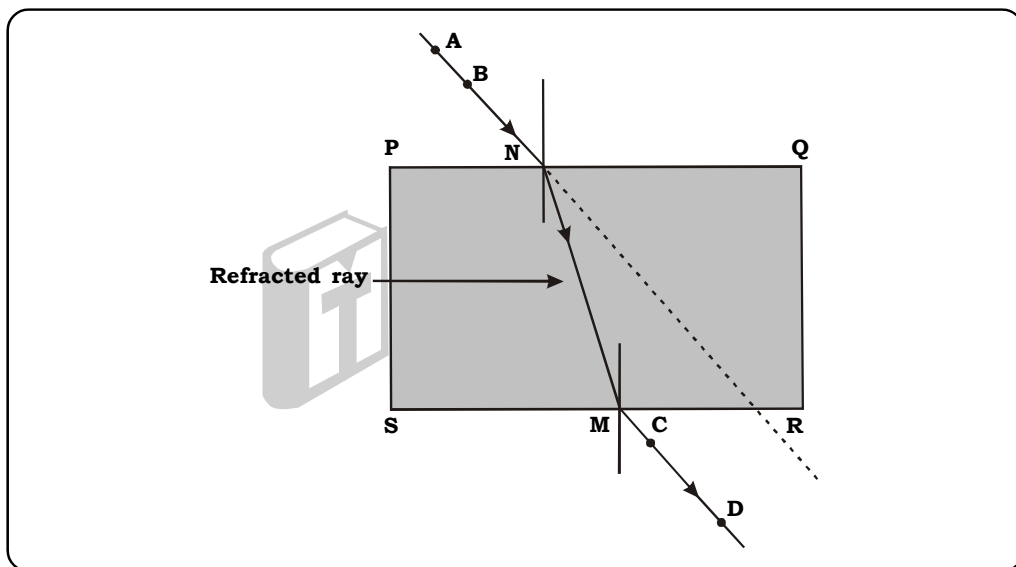
Ans.

Dispersion of light	Scattering of light
1. The phenomenon of splitting of light into its component colours is dispersion.  2. It takes place in a prism.	1. When a ray of light is incident on extremely small particles, the particles deflect the light in different directions. This phenomenon is scattering of light.  2. It takes place due to very fine particles in the atmosphere.

**Q.IV (B) Draw a neat and labelled diagram of the following :**

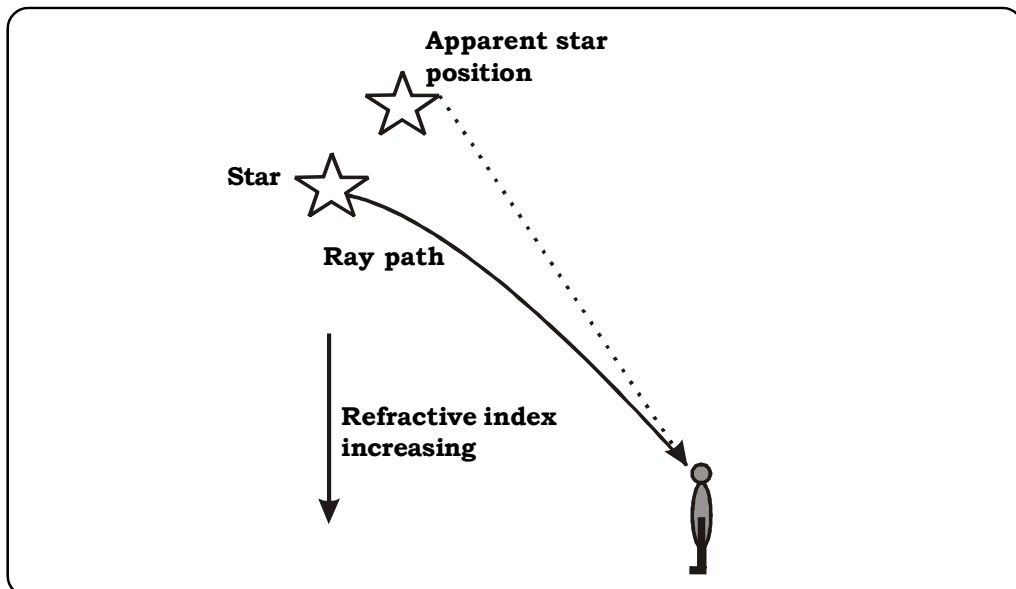
**1. Refraction of light through a glass slab.**

Ans.



**2. Apparent star position.**

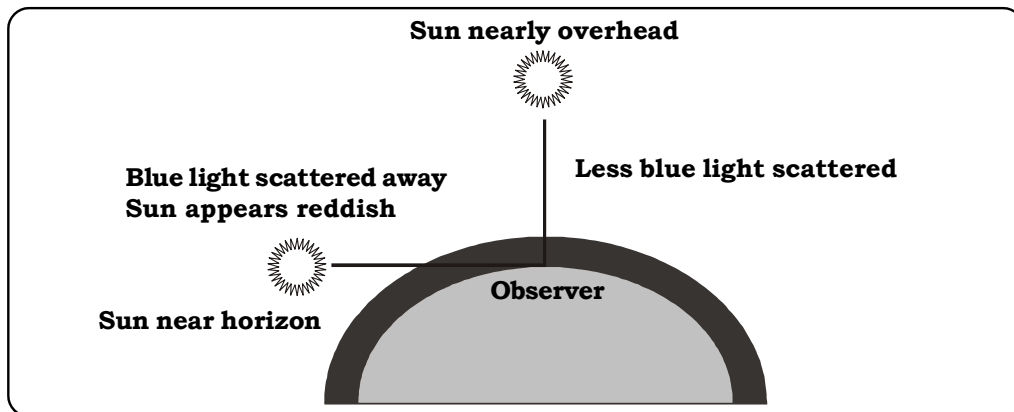
Ans.





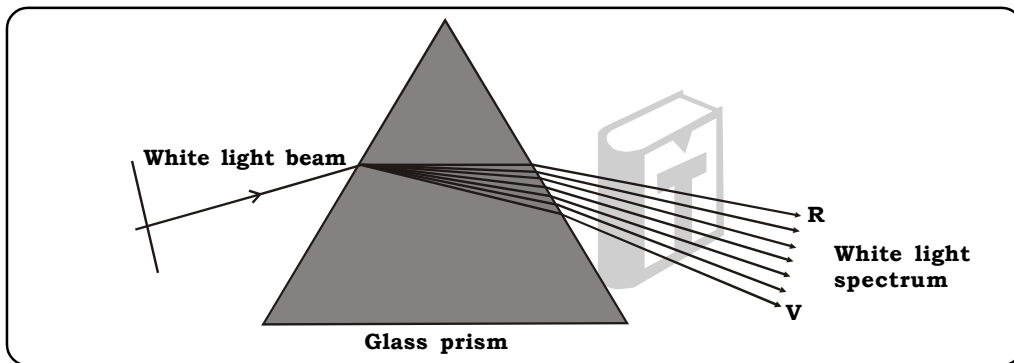
3. Atmospheric refraction of sunrise and sunset.

Ans.



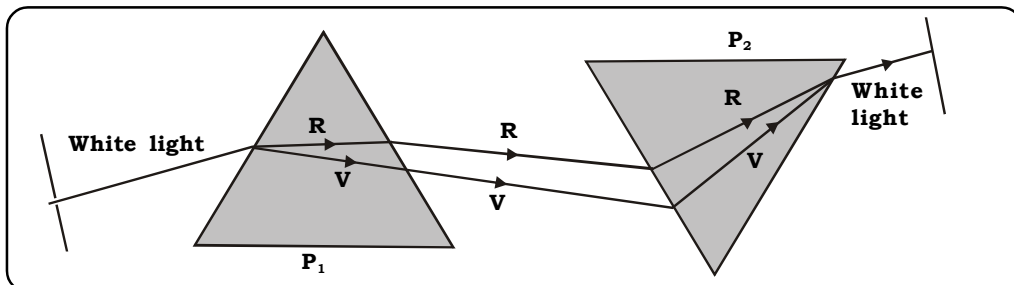
4. Dispersion of light.

Ans.



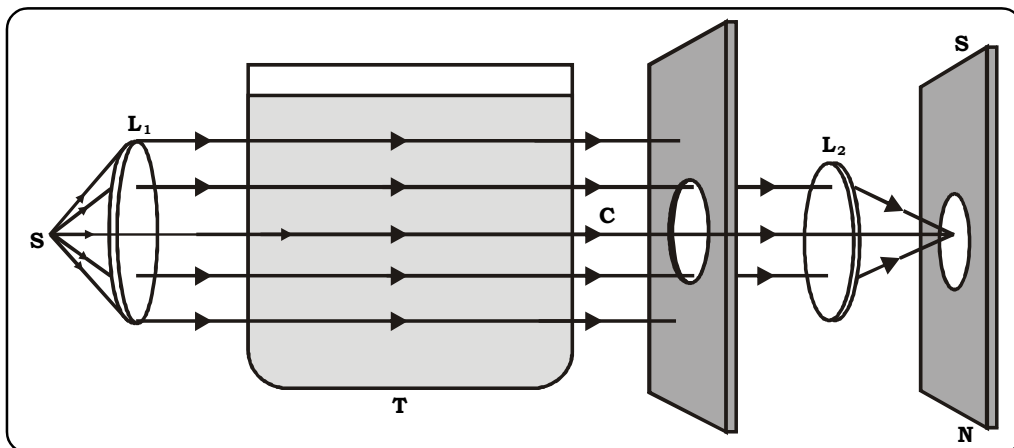
5. Recombination of white light.

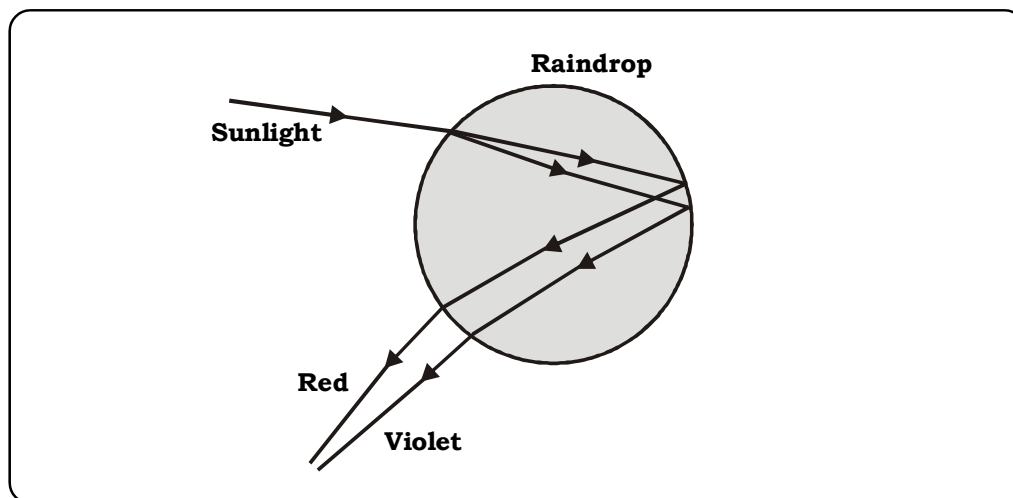
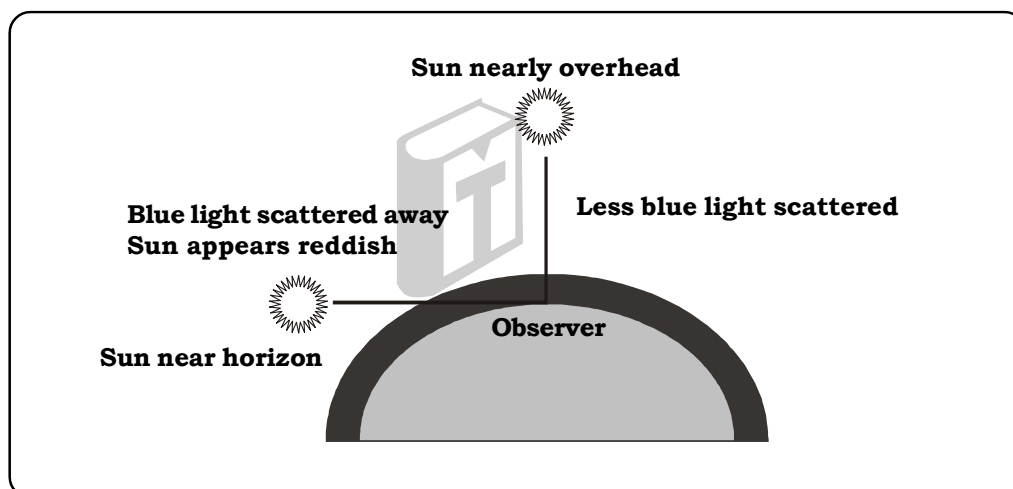
Ans.



6. An arrangement for observing scattering of light in colloidal solution.

Ans.

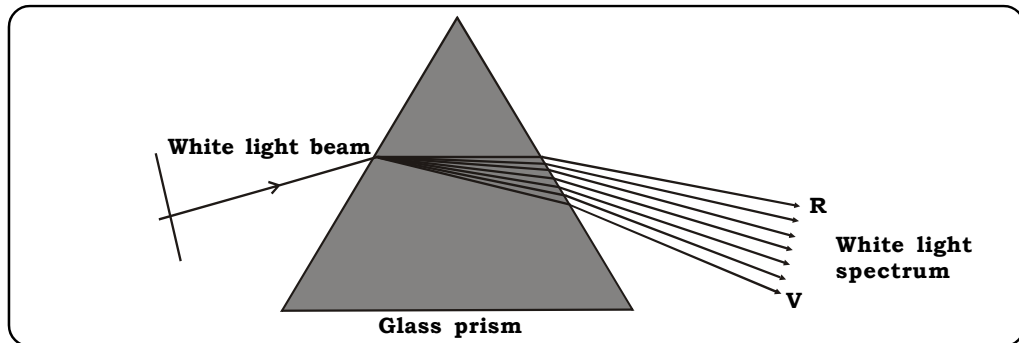


**7. Formation of rainbow.****Ans.****Q.V Answer the following in detail :****\*1. Refraction observed in the atmosphere.****Ans.**

1. In the atmosphere, there are different layers of air with different refractive indices which keep on changing as the physical conditions of air are not stationary.
2. When we observe any object through this air, the light coming from them refract randomly due to which the apparent position of the object fluctuates.
3. The large scale effect of this phenomenon is the twinkling of stars, advanced sunrise and delayed sunset.
4. Due to change in the refractive index of atmosphere, the intensity of light that reaches our eyes from the stars varies and hence the stars appear twinkling at night.
5. Advanced sunrise occurs as a ray of light from the sun enters the earth's atmosphere, it follows a curved path due to refraction before reaching to the observer.
6. It appears to the observer as if the rays are coming from the position. Where the sun is seen by the observer, hence the sun is seen earlier before it reaches the horizon.

**\*2. Dispersion of light.**

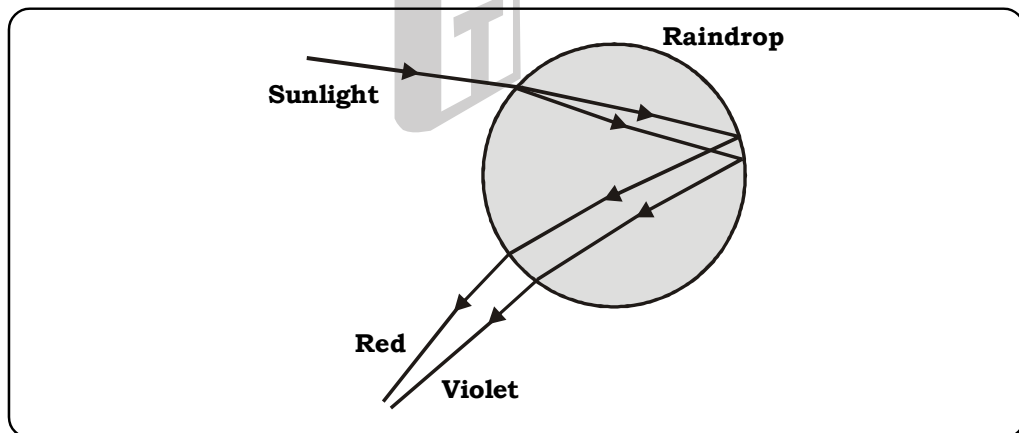
Ans.



1. The phenomenon of splitting of light into its component colours is dispersion.
2. Sir Issac Newton was the first to use a glass prism to obtain the spectrum of sunlight.
3. A prism is a transparent medium bounded by two plane surfaces inclined at an angle.
4. When white light is dispersed into seven colours by a prism, different colours of light bend through different angles with respect to incident ray.
5. Out of these seven colours, red light bends the least while violet light bends the most, as each colour bends in different angle all colours become separate and we get a spectrum of seven different colours.

**3. Explain how formation of rainbow occurs.**

Ans.

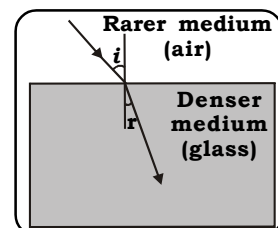


1. The rainbow appears in the sky during a rain shower.
2. The water droplets act as small prisms. When sunlight enters the water droplets present in the atmosphere, they refract and disperse the incident sunlight.
3. Then they reflect it internally inside the droplet and finally again refract it. As a collective effect of all these phenomenon, the seven coloured rainbow is observed.

**4. Explain the propagation of a ray of light, when it travels from rarer to denser medium.**

Ans.

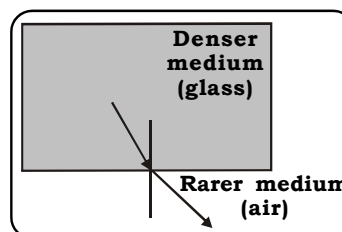
1. When the ray of light moves from an optically rarer medium to an optically denser medium, the ray bends towards the normal.
2. In this case, the refractive index of the second medium is greater than the refractive index of the first medium.



3. The greater the value of refractive index, the more is the bending of refracted ray towards normal. The angle of incidence is greater than the angle of refraction.

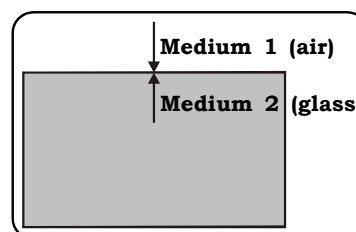
**5. Explain the propagation of a ray of light, when it travels from denser to rarer medium.**

- Ans.**
1. When a ray of light travels from an optically denser medium to an optically rarer medium, the ray bends away from the normal.
  2. Here the refractive index of the first medium is greater than refractive index of the second medium.
  3. The greater the value of refractive index, the lesser is the bending of ray away from the normal.
  4. The angle of refraction is greater than the angle of the incidence.



**6. Explain the propagation of a ray of light, when a ray is incident normal to the interface between any two media.**

- Ans.**
1. A special effect is observed when the ray is incident normal to the interface between any two media in any way i.e. either from rarer to denser or denser to rarer medium.
  2. Here the angle of incidence is zero, hence ray of light propagates undeviated from one medium to another.



**Q.VI Answer the following questions in one sentence each :**

**1. What do you mean by optically denser or optically rarer medium ?**

- Ans.** In refraction of light, the medium of higher refractive index is called optically denser medium, while the optically rarer medium has comparatively lower refractive index.

**2. What does the refractive index depend upon ?**

- Ans.** The refractive index depends upon the relative speed of propagation of light in different media.

**3. Name the natural phenomena seen because of atmospheric refraction.**

- Ans.** Some of the natural phenomena seen due to atmospheric refraction are : Twinkling of stars, advanced sunrise and sunset.

**4. What is dispersion of light ?**

- Ans.** The phenomenon of splitting of light into its component colours is dispersion.

**5. What is spectrum ?**

- Ans.** The band of coloured components of a light beam is called its spectrum.

**6. Why do we see a rainbow in the sky ?**

- Ans.** The beautiful phenomenon of the rainbow in the sky is because of the combination of different phenomena like dispersion, refraction and reflection of light.

**7. A ray of light is refracted from denser medium to a rarer medium. In which direction will the ray bend ?**

- Ans.** When a ray of light is refracted from denser medium to a rarer medium, it will bend away from the normal.

**8. How will the sky appear to an astronaut in the space ?**

- Ans.** For the astronaut the sky will look black or dark.

**9. Name the acronym which helps in remembering the sequence of colour formed due to dispersion of white light.**

- Ans.** The acronym which helps us to remember the colours obtained after splitting of light is 'VIBGYOR'.

**10. Name any three phenomenon based on scattering of light.**

**Ans.** Blue colour of sky, appearance of reddish or orange sky at sunrise or sunset are based on scattering of light.

**11. Which light is scattered easily ?**

**Ans.** Light of shorter wavelengths is easily scattered.

**12. Why red light scatters the least ?**

**Ans.** Red light has greater wavelength than the other colours, hence it scatters the least.

**13. Which colour bends the most and the least while passing through a prism ?**

**Ans.** Violet light bends the most and red light bends the least while passing through a prism.

**Q.VII Solve the following numericals :**

**Type A**

Problem based on the formula :  $\frac{V_1}{V_2} = {}_1\eta_2$

**Solved examples :**

**\*1. The velocity of light in a medium is  $1.5 \times 10^8$  m/s. What is the refractive index of the medium w.r.t. air, if the velocity in air is  $3 \times 10^8$  m/s ?**

**Ans. Given :** Velocity of light in air ( $V_a$ ) =  $3 \times 10^8$  m/s  
Velocity of light in medium ( $V_m$ ) =  $1.5 \times 10^8$  m/s

**To find :** Refractive index of medium w.r.t. air ( ${}_a\eta_m$ )

**Formula :**  $\frac{V_a}{V_m} = {}_a\eta_m$

**Solution :**  $\frac{V_a}{V_m} = {}_a\eta_m$

$$\therefore {}_a\eta_m = \frac{3 \times 10^8}{1.5 \times 10^8}$$

$$\therefore {}_a\eta_m = 2$$

**The refractive index of medium w.r.t. air is 2.**

**\*2. What is the speed of light in diamond if absolute refractive index of diamond is 2.4 and velocity of light in vacuum is  $3 \times 10^8$  m/s ?**

**Ans. Given :** Velocity of light in vacuum ( $V_{vac}$ ) =  $3 \times 10^8$  m/s  
Refractive index of diamond ( ${}_{vac}\eta_{dia}$ ) = 2.4

**To find :** Speed of light in diamond ( $V_{dia}$ )

**Formula :**  ${}_{vac}\eta_{dia} = \frac{V_{vac}}{V_{dia}}$

**Solution :**  ${}_{vac}\eta_{dia} = \frac{V_{vac}}{V_{dia}}$

$$\therefore V_{dia} = \frac{V_{vac}}{{}_{vac}\eta_{dia}}$$

$$\therefore V_{dia} = \frac{3 \times 10^8}{2.4}$$

$$\therefore V_{dia} = 1.25 \times 10^8 \text{ m/s}$$

**The speed of light in diamond is  $1.25 \times 10^8$  m/s.**

- \*3. What is the refractive index of the second medium w.r.t. the first medium if light moves through the first medium with a velocity  $2 \times 10^8$  m/s, which changes to  $1.25 \times 10^8$  m/s in second medium ?**

**Ans. Given :** Velocity in first medium ( $V_1$ ) =  $2 \times 10^8$  m/s  
Velocity in second medium ( $V_2$ ) =  $1.25 \times 10^8$  m/s

**To find :** Refractive index of second medium w.r.t. the first medium ( ${}_1\eta_2$ )

**Formula :**  ${}_1\eta_2 = \frac{V_1}{V_2}$

**Solution :**  ${}_1\eta_2 = \frac{V_1}{V_2}$

$\therefore {}_1\eta_2 = \frac{2 \times 10^8}{1.25 \times 10^8}$

$\therefore {}_1\eta_2 = 1.6$

**The refractive index of the second medium w.r.t. the first medium is 1.6.**

- \*4. Solve and fill in the blanks :**

Velocity in first medium ( $v_1$ )	Velocity in second medium ( $v_2$ )	Refractive index ${}_1\eta_2$	Refractive index ${}_2\eta_1$
$3 \times 10^8$ m/s	$1.2 \times 10^8$ m/s	.....	.....
.....	$2.25 \times 10^8$ m/s	4/3	.....
$2 \times 10^8$ m/s	.....	.....	1.5

**Ans.**

Velocity in first medium ( $v_1$ )	Velocity in second medium ( $v_2$ )	Refractive index ${}_1\eta_2$	Refractive index ${}_2\eta_1$
$3 \times 10^8$ m/s	$1.2 \times 10^8$ m/s	<b>2.5</b>	<b>0.4</b>
<b><math>3 \times 10^8</math> m/s</b>	$2.25 \times 10^8$ m/s	4/3	<b>0.75</b>
$2 \times 10^8$ m/s	<b><math>3 \times 10^8</math> m/s</b>	<b>0.67</b>	1.5

#### HOME WORK ASSIGNMENT - A

- \*1. The speed of light in a transparent medium is  $2.4 \times 10^8$  m/s. Calculate absolute refractive index of the medium.  
(Speed of light in vacuum =  $3 \times 10^8$  m/s) **(Ans. 1.25)**
- \*2. The speed of light in water and glass is  $2.2 \times 10^8$  m/s and  $2 \times 10^8$  m/s, respectively. What is the refractive index of :  
(a) Water w.r.t. glass (b) Glass w.r.t. water. **(Ans. (a) 0.909, (b) 1.1)**
- \*3. Refractive index of water is 4/3 and speed of light in air is  $3 \times 10^8$  m/s. Find speed of light in water. **(Ans.  $2.25 \times 10^8$  m/s)**

**ACTIVITY BASED QUESTIONS****ACTIVITY : 7.1**

(For question refer to Text Book page No. 79)

- Ans.**
1. When the ball is kept in water and observed from sides its size decreases.
  2. Thickness of the pencil increases.
  3. The pencil appears tilted at the interface of air and water.

**ACTIVITY : 7.2**

(For question refer to Text Book page No. 79)

- Ans.** Incident ray and emergent ray are parallel.

**ACTIVITY : 7.3**

(For question refer to Text Book page No. 80)

- Ans.**
1. Transparent plastic slab also refracts light like glass slab.
  2. The Refraction of plastic is different from a glass slab.

**ACTIVITY : 7.4**

(For question refer to Text Book page No. 82)

- Ans.** We observe a band of seven different colours in the order of violet, indigo, blue, green, yellow, orange and red.

**ACTIVITY : 7.5**

(For question refer to Text Book page No. 83)

- Ans.**
1. A beam of white light is observed.
  2. When light is made to pass through a prism it undergoes dispersion but if a dispersed light is made to pass through an inverted prism it recombines.

**ACTIVITY : 7.6**

(For question refer to Text Book page No. 84)

- Ans.**
1. The beam of light is visible in beaker 2 and 3 as it is a colloidal solution.
  2. The beam of light is not visible in beaker 1, as  $\text{KMnO}_4$  solution contains very small particles.

**ACTIVITY : 7.7**

(For question refer to Text Book page No. 84)

- Ans.** The resultant colour is white from which we understand that white is a mixture of seven different colours.

**ACTIVITY : 7.8**

(For question refer to Text Book page No. 85)

- Ans.**
1. From the sides of beaker we can see blue colour.
  2. The colour of the image on the screen appears red as red light is least scattered by the colloidal particles.

**HOTS QUESTIONS & ANSWERS**

- 1. If refractive index of 2nd medium with respect to 1st medium is 2 then what is the refractive index of 1st medium with respect to 2nd medium.**

**Ans.** The refractive index of 1st w.r.t. 2nd and 2nd w.r.t. 1st are reciprocal.

$$\therefore {}_2\eta_1 = \frac{1}{2}$$
$$\therefore {}_2\eta_1 = 0.5$$

- 2. When light travels from rarer medium to denser medium. If the angle of incidence is 30° can the angle of refraction be 41°. Why ?**

**Ans.** (a) No, because when the light travels from rarer to denser it will bend towards the normal.  
(b) Hence the angle of refraction will be less than angle of incidence.

- 3. Traffic signal does not use violet colour.**

**Ans.** (a) During dispersion of light amongst red, orange, yellow, green, blue indigo and violet, violet turns the most.  
(b) Because of this it would not be visible to a far away person.

- 4. When light travels from water to alcohol, where will it bend.**

**Ans.** (a) The refractive index of water is 1.36 and alcohol is 1.44.  
(b) Hence water is rarer medium as compared to alcohol.  
(c) So light will bend towards the normal.

- 5. A person walking in desert gets a illusion of seeing water. Name the phenomenon of light responsible for it.**

**Ans.** The phenomenon is called as mirage, it happens because of total internal reflection.





## CHAPTER 7 : WONDERS OF LIGHT - II

SCIENCE

Duration : 1 hr.

**Q.I [A] Choose the correct alternatives and rewrite the complete sentences :** **4**

1. The phenomenon of change in the ..... of light when it passes from one transparent medium to another is refraction.
  - (a) direction
  - (b) wavelength
  - (c) frequency
  - (d) amplitude
2. The apparent position of a star in the sky is ..... .
  - (a) slightly lower than its actual position.
  - (b) slightly higher than its actual position
  - (c) same as that of its actual position.
  - (d) far away from its actual position.
3. When white light is dispersed into seven colours ..... colour bends least.
  - (a) Green
  - (b) Yellow
  - (c) Violet
  - (d) Red
4. Twinkling of stars is due to change in ..... of atmosphere.
  - (a) temperature
  - (b) refractive index
  - (c) pressure
  - (d) climate

**Q.I [B] Match the columns :** **4**

- | <b>1. Column A</b>           | <b>Column B</b>                  |
|------------------------------|----------------------------------|
| 1. Refraction                | (a) With respect to vacuum       |
| 2. Refractive index          | (b) $\frac{\sin i}{\sin r}$      |
| 3. Absolute refractive index | (c) Spectrum                     |
|                              | (d) Change in direction of light |
|                              | (e) Mirage                       |

**Q.I [C] State whether True or False :** **2**

1. The greater is the value of refractive index, the more is the bending of refracted ray towards the normal.
2. The hotter air is rarer than the cooler air.

... 2 ...

**Q.I [D] Find the odd man out : 2**

1. Dispersion, Mirage, Refraction, Induction.
2. Twinkling of stars, Advanced sunrise, Delayed sunset, Blue sky.

**Q.II Answer the following : (Any Three) 6**

1. Distinguish between Refraction and Dispersion.
2. A coin immersed in water or bottom of a swimming pool appears raised. Why ?
3. The sky appears dark, instead of blue to a person located in space. Why ?
4. The sun appears reddish early in morning. Why ?

**Q.III Draw a neat and labelled diagram of the following : (Any Two) 4**

1. Recombination of white light.
2. Formation of rainbow.
3. An arrangement for observing scattering of light in colloidal solution.

**Q.IV Solve the following numericals : (Any Two) 4**

1. The speed of light in a transparent medium is  $2.4 \times 10^8$  m/s. Calculate the absolute refractive index of the medium. (Speed of light in vacuum =  $3 \times 10^8$  m/s)
2. What is the speed of light in diamond if absolute refractive index of diamond is 2.4 and velocity of light in vacuum is  $3 \times 10^8$  m/s ?
3. The speed of light in water and glass is  $2.2 \times 10^8$  m/s and  $2 \times 10^8$  m/s, respectively what is the refractive index of :  
(a) Water w.r.t. glass                      (b) Glass w.r.t. water.

**Q.V Answer the following questions in brief : (Any One) 4**

1. Explain the dispersion of light.
2. Explain refraction observed in the atmosphere.

*Best Of Luck* 🍀