PRISM WORLD

Std.: 10 (English) **Science - I**

Chapter: 6

Q.1 **Textbook activity question** **7**

1 You must have seen chandeliers having glass prisms. The light from a tungsten bulb gets dispersed while passing through these prisms and we see coloured spectrum. If we use an LED light instead of a tungsten bulb, will we be able to see the same effect?

Ans Light emitted by LED (light-emitting - diodle) does not have all wavelengths in the region 400nm to 700 nm. Hence, its spectrum is not the same as that of light from a tungsten bulb or as that of sunglight.

2 Have you seen that objects beyond and above a holi fire appear to be shaking? Why does this happen?

Ans i. Local atmospheric conditions affect the refraction on light.
ii. The air near holi flames is hot and hence rarer than the air above it.
iii. The refractive index of air keep increasing and the direction of light rays coming from objects beyond the holi fire changes due to changing refractive index above the fire.
iv. Thus, the objects appear to be moving.

3 Have you seen a mirage which is an illusion of the appearance of water on a hot road or in a desert?

Ans

Yes, I have seen a mirage which is an illusion of the appearance of water on a hot road or in a desert.

4 If the refractive index of second medium with respect to first medium is ${}_2n_1$ and that of third medium with respect to second medium is ${}_3n_2$, what and how much is ${}_3n_1$?

Ans ${}_2n_1 = \frac{n_2}{n_1}$ ... (1)

${}_3n_2 = \frac{n_3}{n_2}$ ... (2)

multiply (1) and (2)

${}_2n_1 \times {}_3n_2 = \frac{n_2}{n_1} \times \frac{n_3}{n_2}$

${}_3n_1 = \frac{n3}{n_1}$

5 From incident white light how will you obtain white emergent light by making use of two prisms?

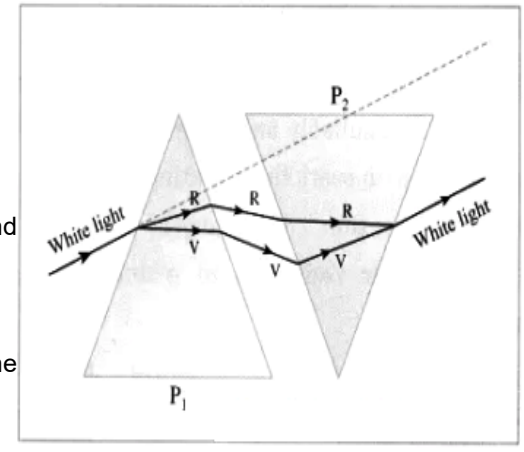
Ans i. Take a prism. Allow white light to fall on it.

ii. Obtain a spectrum.

iii. Take a second identical prism.

iv. Allow the colours of the spectrum to pass through the second prism.

v. Obtain the beam of light emerging from the other side of the second prism.



(Schematic diagram)

6 Will light travel through a glass slab with the same velocity as it travels in air?

Ans No, light will not travel through a glass slab with the same velocity as it travels in airbecause the glass slab blocks the path of light. No light will not travel with same velocity in glass because glase has more rrefrective index that's why ligh not trave with same velocity in glass.

7 Will the velocity of light be same in all media?

Ans No. It will be different for different media. This is because different media have different refractive index.

Q.2 **Multiple Choice Questions** **3**

1 We can see the sun even when it is little below the horizon because of ..... .
a. reflection of light
b. refraction of light
c. dispersion of light
d. absorption of light

Ans Option b.

2 If the refractive index of glass with respect of air is $\frac{3}{2}$, what is the refractive index of air with respect to glass ?
a. $\frac{1}{2}$ b. 3 c. $\frac{1}{3}$ d. $\frac{2}{3}$

Ans Option d.

3 If the refractive index of glass with respect of air is $\frac{3}{2}$, what is the refractive index of air with respect to glass ?
a. $\frac{1}{2}$ b. 3 c. $\frac{1}{3}$ d. $\frac{2}{3}$

Ans Option d.

Q.3 **Solve Numerical problems.** **6**

1 If the speed of light in a medium is 1.5 x 10^8 m/s what is the absolute refractive index of the medium.

Ans Given: speed of light in medium = 1.5 x 10^8 m/s
speed of light in vacuum = 3 x 10^8 m/s
Absolute refractive index = $\frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}}$
= $\frac{3\times10^8\ \text{m/s}}{1.5\times10^8\ \text{m/s}}$ = 2
$\therefore$ **2** is the absolute refractive index of the medium.

2 The absolute refractive index of water is 1.36. What is the velocity of light in water? (velocity of light in vacuum 3 × 10^8 m/s)

Ans V_1 = 3 × 10^8 m/s
n = 1.36
n = $\frac{V_1}{V_2}$ 1.36 = $\frac{3\times10^8}{V_2}$
V_2 = $\frac{3\times10^8}{1.36}$= 2.21 × 10^8 m/s

3 If the absolute refractive indices of glass and water are $\frac{3}{2}$ and $\frac{4}{3}$ respectively. What is the refractive index of glass with respect to water.

Ans Given: absolute refractive index of glass = $\frac{3}{2}$
$\frac{3}{2}$ = $\frac{\text{Speed of light in vacuum}}{\text{Speed of light in glass}}$
$\therefore$ Speed of light in glass = $\frac{2}{3}$ × speed light in vacuum.
= $\frac{4}{3}$ = absolute refractive index of water
$\frac{4}{3}$ = $\frac{\text{Speed of light in vacuum}}{\text{Speed of light in water}}$
$\therefore$ Speed of light in water = $\frac{3}{4}$ × Speed of light in vacuum.
Refractive index of glass with respect its water = $\frac{\text{Refractive index of glass with air}}{\text{Refractive index of water}} = \frac{\frac{3}{2}}{\frac{4}{3}}$ = $\frac{9}{8}$
$\therefore$ $\frac{9}{8}$ is the refractive index of glass with respect to water.

Q.4 **Write properties/characteristic/uses/advantages/effects.** **2**

1 What is the correct reason for blinking / flickering of stars? Explain it.

i. The blasts in the stars.

ii. Absorption of star light by the atmosphere.

iii. Motion of the stars.

iv. Changing refractive index of gases in the atmosphere.

Ans (iv) Changing refractive index of gases in the atmosphere is the correct reason.

a. Atmosphere is unstable due to changing density and temperature of air, hence refractive index of air keeps changing continuously.

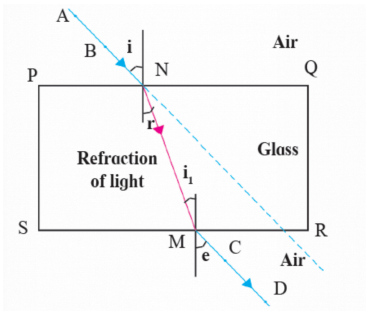
b. The position and brightness of the star keep changing continuously and the star appears to be twinkling.

Q.5 **Answer the following** **6**

1 Prove the following statement along with the diagram.

If the angle of incidence and angle of emergence of a light ray falling on a glass slab are i and e respectively. Prove that i = e.

Ans



in figure. PQ || SR

NM is a refracted ray.

$\therefore \quad r = i_1$

By the laws of refraction,

$${}_gn_a = \frac{\sin i}{\sin r}; \; {}_an_g = \frac{\sin i_1}{\sin e}$$

$$\therefore \quad {}_gn_a = \frac{1}{{}_an_g}$$

$$\therefore \quad \frac{\sin i}{\sin r} = \frac{\sin e}{\sin i_1} \qquad \text{... but } r = i_1$$

$$\therefore \quad \sin i = \sin e$$

$$\therefore \quad i = e$$

2 A rainbow is the combined effect of the refraction, dispersion and total internal reflection of light. Explain this statement.

Ans i. Rainbow is a beautiful natural phenomenon.

ii. It is a combined effect of a number of natural processes.

iii. The rainbow appears in the sky after a rain shower.

iv. The water droplets act as small prism.

v. When sunlight enter the water droplets present in the atmosphere, They refract and disperse the incident sunlight.

vi. Then they reflect it internally inside the droplet and finally again refract it.

viii. As a collective effect of all there phenomenon the seven coloured rainbow is formed.