

UNIT 5

Refraction of Light

19/12/2020 – Class 40

Assignment Answer

1. Why the pencil, appeared to be broken, when it is placed in the water obliquely as in the figure?



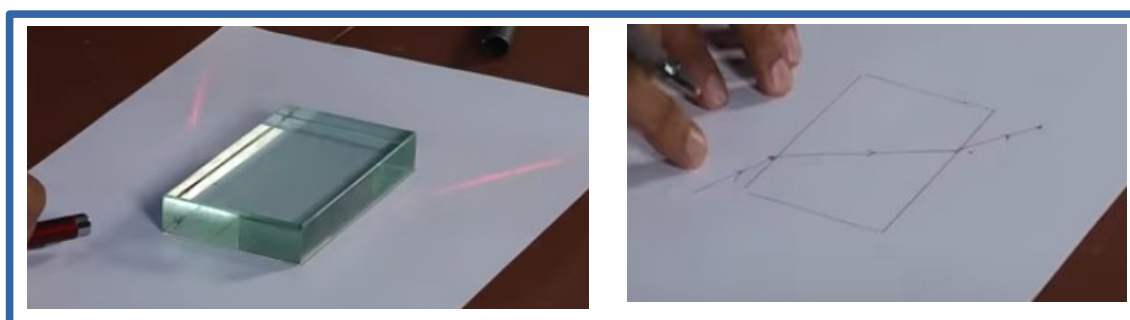
Refraction of light.

Activity 1

Will the deviation of a ray of light entering from air to other media also be alike?

Experiment

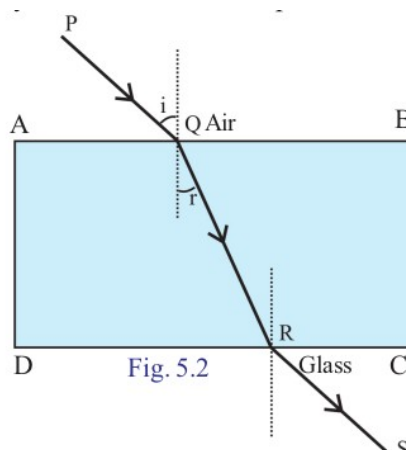
Place a glass slab on a drawing sheet and mark its boundary as ABCD. Remove the glass slab and draw a line PQ on the side AB. Keeping the glass slab in position, pass light from a laser torch through it along PQ. Observe the path of light through the glass slab. Mark the points Q, R and S. Depict the path of light PQRS by joining QR and RS.



Discussion

- Does whole light incident on the glass slab passes through it? **No, a part of the light reflected back to the same medium.**
- When light enters from air to glass, what happens to its path? **A deviation take place at the surface of separation of air and glass.**
- This deviation of light is called? **Refraction of light.**
- What is the reason for this deviation (refraction)? **The optical densities of air and glass are different.**
- When this light comes out from the glass slab to air, what happens? **Here also refraction occurs.**
- Here, how many times refraction occurs? **Two times.**
- Which are they? **When light enters from the air to the glass slab and light comes out from the glass slab to the air.**

Observe the diagram, showing the refraction through a glass slab.



Discussion

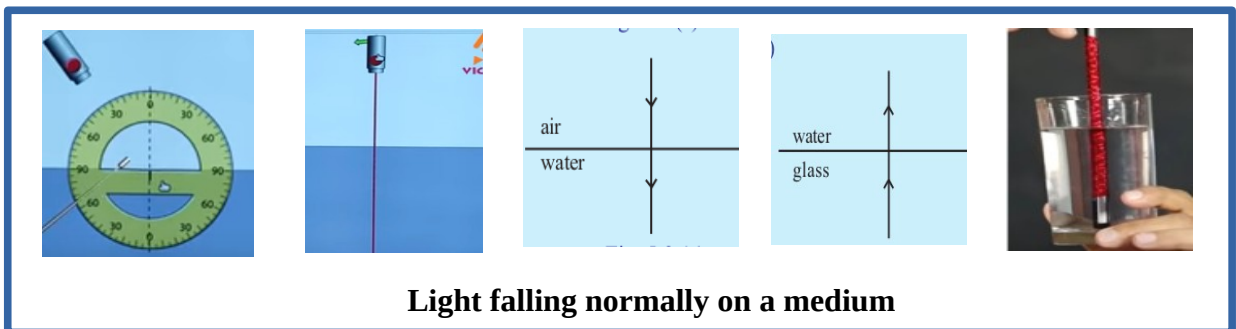
- In the figure, which is the surface of separation between air and glass? **AB.**
- Which is the incident ray on the surface of separation of AB? **PQ.**
- Which is the refracted ray on the surface of separation of AB? **QR.**
- Which is the point of incidence at the surface AB? **Q.**
- The angle between the incident ray (PQ) and the normal drawn at Q is called? **Angle of incidence (i).**
- The angle between the refracted ray (QR) and the normal is called? **Angle of refraction (r)**
- Which is the incident ray on the surface of separation of CD? **QR.**
- Which is the refracted ray on the surface of separation of CD? **RS.**
- Which is the angle of incidence on the surface of separation of CD? **Angle between the incident ray (QR) and the normal drawn at the point of incidence (R).**
- Which is the angle of refraction on the surface of separation of CD? **Angle between the refracted ray (RS) and the normal drawn at the point of incidence (R).**

Inference

- ➔ Angle between the incident ray and the normal is called **angle of incidence (i).**
- ➔ Angle between the refracted ray and the normal is called **angle of refraction (r).**

Activity 2

Light ray falling normally on a medium.



Light falling normally on a medium

Discussion

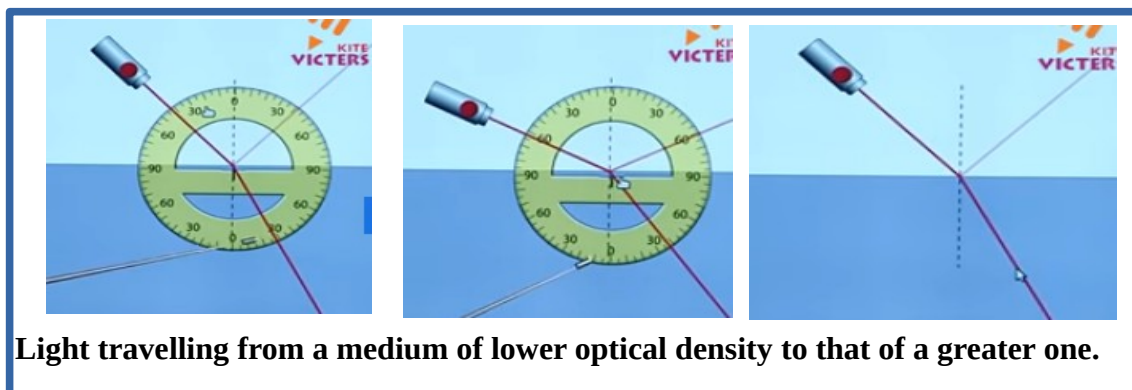
- Does refraction take place, when light falling normally on a medium? **No**

Inference

No deviation takes place in the case of a light ray falling normally on a medium.

Activity 3

Light travels from air to glass.



Light travelling from a medium of lower optical density to that of a greater one.

Discussion

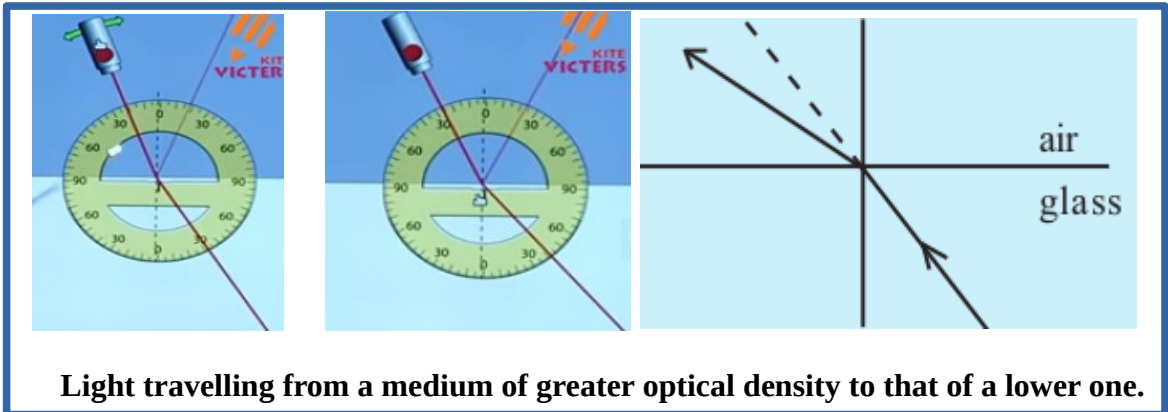
- Here, light travels from which medium to which medium? **Air to glass.**
- Which medium has greater optical density, air or glass? **Glass.**
- Which has lesser optical density? **Air.**
- Refracted ray is deviated away from the normal or towards the normal? **Deviates towards the normal.**

Inference

While entering from air to glass (from a medium of lower optical density to that of a greater one) the refracted ray deviates towards the normal.

Activity 4

Light travels from glass to air.



Discussion

- Now light travels from which medium to which medium? **Glass to air (medium of greater optical density to that of a lower one)**
- Refracted ray is deviated away from the normal or towards the normal? **Deviates away from the normal.**

Inference

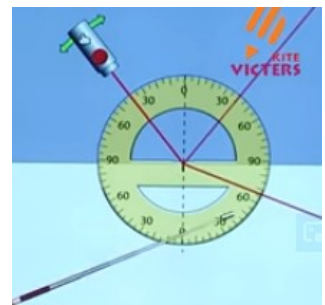
While entering from glass to air (from a medium of greater optical density to that of a lower one) the refracted ray deviates away from the normal.

Activity 5

Observe the refraction in the figure.

Discussion

- Does the angle of incidence, angle of refraction and the normal at the point of incidence on the surface of separation of the two media are on the same plane? **Yes.**



Inference

The angle of incidence, the angle of refraction and the normal at the point of incidence on the surface of separation of the two media will always be in the same plane.

Activity 6

The experimental results of a ray of light entering from air to glass slab is tabulated.

From air to glass

Sl. No.	Angle of incidence (i)	Angle of refraction (r)	sin i	sin r	sin i/sin r
1	20°	13°	0.34	0.22	1.5
2	30°	19.45°	0.5	0.33	1.5
3	45°	28°	0.7	0.47	1.5
4	60°	35°	0.86	0.57	1.5

Discussion

- When the angle of incidence (i) increases, what happens to the angle of refraction(r)? **Angle of refraction also increases.**
- What speciality is observed in the value of ratio of sine of the angle of incidence to the sine of the angle of refraction, ($\sin i / \sin r$)? **It is a constant.**
- This constant is called? **Refractive index.**

Inference

- ➔ When light passes through different pairs of media, the angle of refraction increases with the angle of incidence.
- ➔ The ratio of the sine of the angle of incidence to the sine of the angle of refraction($\sin i/\sin r$) will be a constant. This constant is known as **refractive index**. This is indicated by the letter n .

Laws of Refraction

- **The angle of incidence, the angle of refraction and the normal at the point of incidence on the surface of separation of the two media will always be in the same plane.**
- **The ratio of the sine of the angle of incidence to the sine of the angle of refraction $\left(\frac{\sin i}{\sin r}\right)$ will always be a constant. This is known as Snell's Law.**

The constant from Snell's Law is known as refractive index. This is indicated by the letter n .

Assignment

Draw the refraction of light through the glass slab?