

Girls' High School & College, Prayagraj

Worksheet No. - 4

Session 2020-2021

Class - X A B C D E F

Subject- Physics

Chapter- Refraction of Light at plane Surfaces

Instructions: - Parents are expected to ensure that the student spends two days to read and understand the chapter according to the books and website referred and thereafter answer the given questions. Student should refer to the following books/website-

Concise Physics, for class 10 By R. P. Goyal and S. P. Tripathi (Selina Publishers) OR

A New Approach to I.C.S.E. Physics by V. K. Sally and R N Das Gupta (Goyal Brothers Prakashan) OR

ICSE Physics By S C Gupta and Smita Aggarwal (Srijan Publishers) OR

website-http://quiznext.in/study-material/learning_material/ICSE-10-Physics/Refraction-of-Light-at-Plane-Surfaces/refraction-laws-of-refraction-and-refractive-index/

Topics: - 1. REFRACTION, LAWS OF REFRACTION AND REFRACTIVE INDEX
2. REFRACTION OF LIGHT THROUGH A PRISM
3. SIMPLE APPLICATIONS OF REFRACTION OF LIGHT
4. CRITICAL ANGLE AND TOTAL INTERNAL REFLECTION

1) Questions based on Refraction, Laws of Refraction and Refractive Index:-

(A) Answer the following questions briefly: -

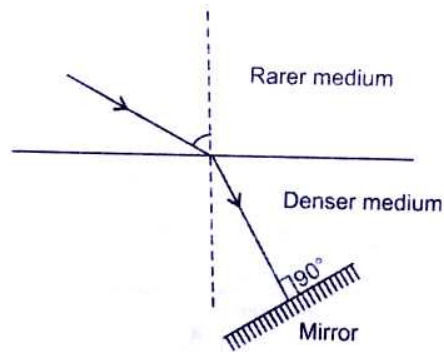
Q.1:- A ray of light is incident normally on a plane glass slab. What will be

- i) the angle of refraction, and
- ii) the angle of deviation for the ray?

Q.2:- What is the cause of refraction of light when it passes from one medium to another?

Q.3:- State the Snell's laws of refraction of light.

Q.4:- A ray of light is moving from a rarer medium to a denser medium and strikes a plane mirror placed at 90° to the direction of the ray as shown in the diagram.



- Copy the diagram and mark arrows to show the path of the ray of light after it is reflected from the mirror.
- Name the principle you have used to mark the arrows to show the direction of the ray.

Q.5:- Name two factors on which the refractive index of a medium depends? State how does it depend on the factors stated by you.

Q.6:- What is lateral displacement? Draw a ray diagram showing the lateral displacement of a ray of light when it passes through a parallel sided glass slab.

- Q.7:-**
- For which colour of white light, is the refractive index of a transparent medium (i) the least, (ii) the most?
 - Which colour of light travels fastest in any medium except air?

Q.8:- A light ray passes from water to (i) air, and (ii) glass. In each case, state how does the speed of light change.

Q.9:- In an experiment of finding the refractive index of glass, if blue light is replaced by the red light, how will the refractive index of glass change? Give reason in support of your answer.

Q.10:- Define the term refractive index of a medium. Can it be less than 1?

The following:

- a) What is the angle of incidence on the first face of the prism?
- b) What is the angle of refraction from the first face of the prism?
- c) What will be the angle of incidence at the second face of the prism?
- d) Will the light ray suffer minimum deviation by the prism?

Q.5:- How does the angle of minimum deviation produced by a prism change with increase in (i) the wavelength of incident light, and (ii) the refracting angle of prism?

(B) Multiple choice questions: -

Q.6:- Angle of deviation is the angle which the _____ ray makes with the direction of incident ray.

- a) incident
- b) emergent
- c) normal
- d) refracted.

Q.7:- In refraction of light through a prism, the light ray :

- a) suffers refraction only at one face of the prism
- b) emerges out from the prism in a direction parallel to the incident ray
- c) bends at both the surfaces of prism towards its base
- d) bends at both the surfaces of prism opposite to its base.

Q.8:- In the position of minimum deviation, the _____ ray inside the prism is parallel to its base, if the prism is equilateral.

- a) incident
- b) emergent
- c) normal
- d) refracted.

3) Questions based on Simple Application of Refraction of Light:-

(A) Answer the following questions briefly:-

Q.1:- Draw a ray diagram to show the appearance of a stick partially immersed in water.

Explain your answer.

Q.2:- Name two factors on which the magnitude of shift depends and state how does it depend on them.

Q.3:- Explain the following-

- a) A print appears to be raised when a glass slab is placed over it.
- b) A pencil partially immersed in water, appears bent.
- c) A star appears twinkling in the sky.
- d) A person's legs appear to be short when standing in a water tank.

(B) Multiple choice questions: -

Q.4:-The shift _____ with the increase in the wavelength of light used.

- a) increases
- b) decreases
- c) remains same.

Q.5:- A plane glass slab is kept over various coloured letters. The letter, which appears the least raised, is of :

- a) blue colour
- b) violet colour
- c) red colour.

(C) Numerical problems :-

Q.6:- A water pond appears to be 2.7 m deep. If the refractive index of water is $\frac{4}{3}$, find the actual depth of the pond.

Q.7:-A coin is placed at the bottom of a beaker containing water (refractive index = $\frac{4}{3}$) to a depth of 12 cm. By what height the coin appears to be raised when seen from vertically above?

4) Questions based on Critical Angle and Total Internal Reflection:-

(A) Answer the following questions briefly:-

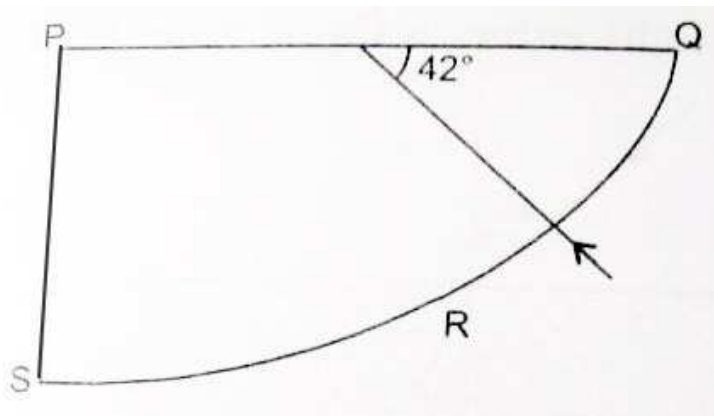
Q.1:- What is meant by

- a) critical angle;
- b) total internal reflection?

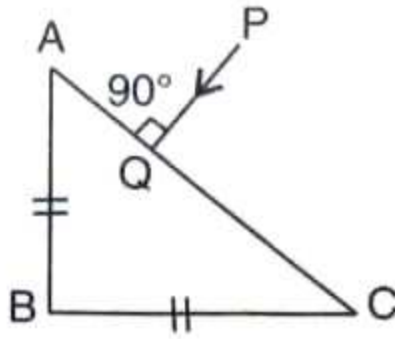
Q.2:- State two conditions necessary for the total internal reflection to occur.

Q.3:- Name two factors which affect the critical angle for a given pair of media. State how do the factors affect it.

Q.4:- A ray of light enters a glass slab PQRS, as shown in the diagram. The critical angle of the glass is 42° . Copy this diagram and complete the path of the ray till it emerges out from the glass slab. Mark the angles in the diagram wherever necessary.

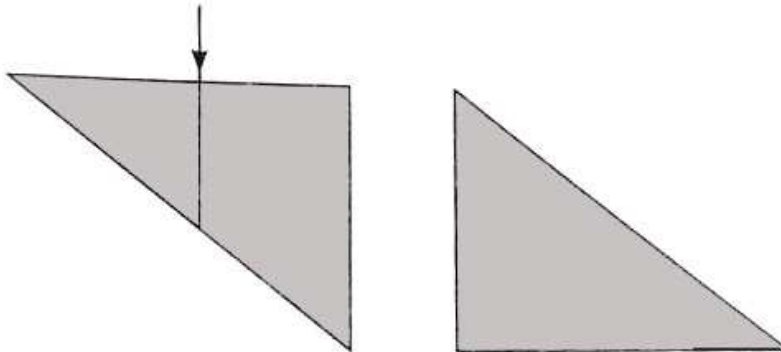


Q.5:- In the diagram given below , a ray of light PQ is incident normally on the hypotenuse of an isosceles right angled prism ABC.



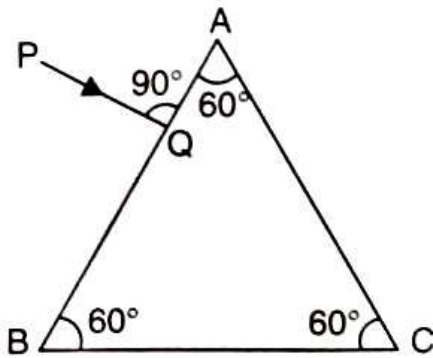
- a) Complete the path of the ray PQ till it emerges from prism. Mark in the diagram the angle wherever necessary.
- b) What is the angle of deviation of the ray PQ?
- c) Name a device in which this action is used.

Q.6:- Two isosceles right-angled glass prisms are placed near each other as shown in the figure.



Complete the path of the light ray entering the first isosceles right-angle glass till it emerges from the second identical prism.

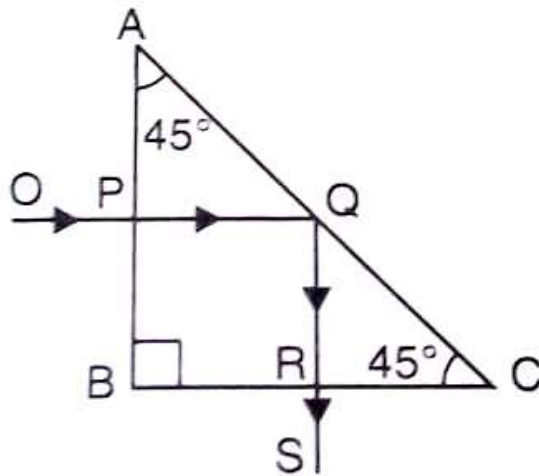
Q.7:- In the diagram given below, a ray of light PQ is incident normally on the face AB of an equilateral glass prism. Complete the ray diagram showing its emergence into air after passing through the prism. Take critical angle for glass = 42° .



- a) Write the angles of incidence at the faces AB and AC of the prism.
- b) Name the phenomenon which the ray of light suffers at the face AB, AC and BC of the prism.

Q.8:- Show with the help of a diagram how a total reflecting prism can be used to turn a ray of light through 90° . Name one instrument in which such a prism is used.

Q.9:- A ray of light OP passes through a right angled prism as shown in the diagram given below.



- a) State the angles of incidence at the faces AC and BC.
- b) Name the phenomenon which the ray suffers at the face AC.

END