UNIT 5

Refraction of Light

22/12/2020 – Class 42

Assignment Answer

1) Refractive index of some media are given below. Analyse the table and answer the following questions.

Medium	Refractive index
Water	**1.33**
Sunflower oil	**1.47**
Diamond	**2.42**
Kerosene	**1.44**

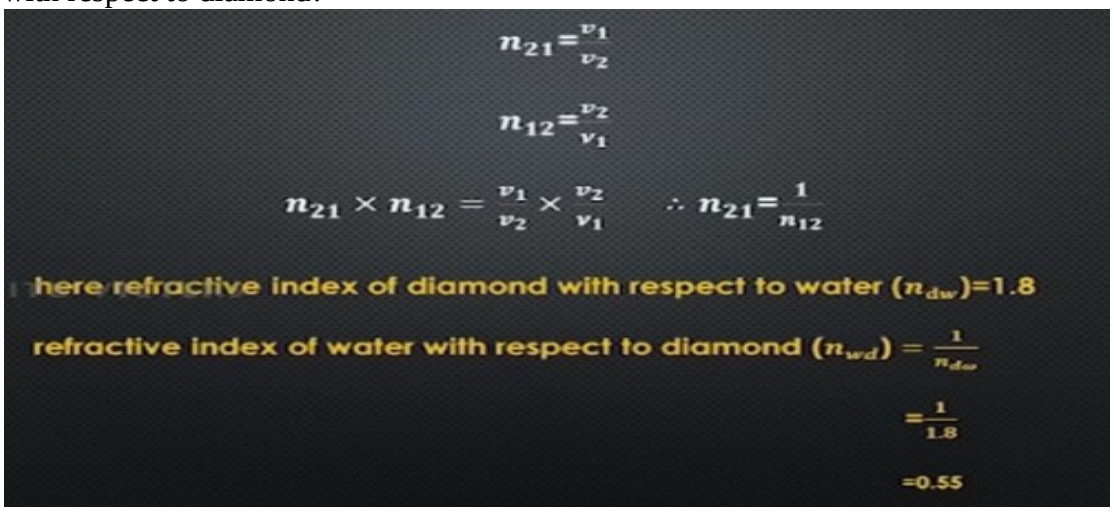
a) Choose the media of highest and lowest optical density from the table?

Highest optical density – Diamond, Lowest optical density - Water

b) What are the media having highest and lowest velocity of light?

Highest velocity of light – Water, Lowest velocity of light – Diamond

c) If the refractive index of diamond with respect to water is 1.8 then, what is the refractive index of water with respect to diamond?



or

Refractive index of water with respect to diamond

= Refractive index of water / Refractive index of diamond

= 1.33 / 2.42 = 0.55

2) Refractive index of some media are given below.

Media	Refractive index
Water	**1.33**
Sunflower oil	**1.47**
Pyrex glass	**1.47**
Glycerine	**1.47**

Glycerine, water and sunflower oil are taken in two beakers. A glass rod is dipped in one and a Pyrex glass rod is dipped in the other.

a) Do the glass rod and Pyrex glass rod appear in the same way?

No glass rod appears completely. But Pyrex glass rod appears partially.

b) In which media are they visible. Justify your answer?

Glass rod is visible in all medium, but Pyrex glass rod is visible only in water. Because refractive index of glycerine, sunflower oil, and Pyrex glass rod are same. That's why Pyrex glass rod is not visible in glycerine and sunflower oil.

Activity 1

Take a jar and fill half of it with water. Fill the remaining part of the jar with smoke.

Activity	Observation
Allow light from a laser torch to fall obliquely on the water in the jar. 	When light enters from, water to air refraction taking place. A part of the light is reflected back to the same medium (water).
Allow the light from the laser torch to fall on the water in the jar, with greater angle of incidence. 	When the angle of incidence is increased angle of refraction also increased.
Repeat the activity after increasing the angle of incidence again. 	Refracted ray passes along the surface of water. (Angle of refraction is 90^0) 

Angle of incidence is again increased and repeat the experiment.  	Refraction doesn't taking place. Light completely reflected back to the same medium (water). 

Discussion

- In this experiment, light travels from which medium to which medium? **Water to air.**
- Which medium has greater optical density? **Water.**
- What will be the angle of refraction when the refracted ray passes along the surface of water? **90^0**
- Angle of incidence, at which the angle of refraction becomes 90^0 is the.....? **Critical angle.**

Inference

When a ray of light passes from a medium of greater optical density to that of lower optical density, the angle of incidence at which the angle of refraction becomes 90^0 is the **critical angle**. The critical angle in water is 48.6^0.

- When light is incident on the surface of water, with an angle greater than critical angle, what happens? **Refraction doesn't taking place. Light ray completely reflected back to the water.**
- This is called? **Total internal reflection.**

Inference

When a ray of light passes from a medium of higher optical density to a medium of lower optical density at an angle of incidence greater than the critical angle, the ray is reflected back to the same medium without undergoing refraction. This phenomenon is known as **total internal reflection.**

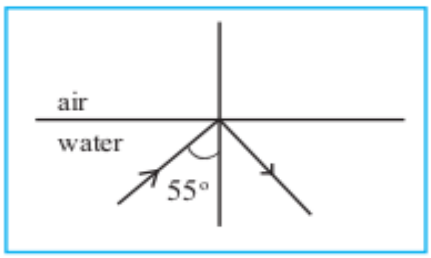
Conditions for total internal reflection

➔ Light ray should travel from a medium of **higher optical density** to a medium of **lower optical density**.

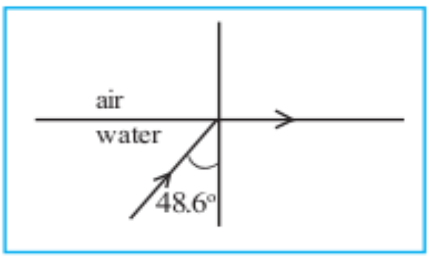
➔ Angle of incidence should be greater than **critical angle.**

Activity 2

The path of light in different media is shown in the figures. Analyse them and answer the following questions.



(a)



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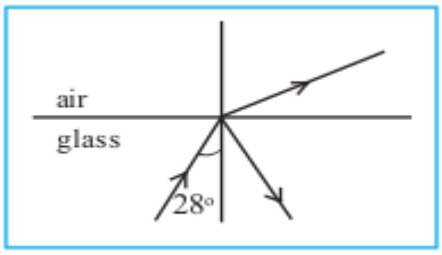

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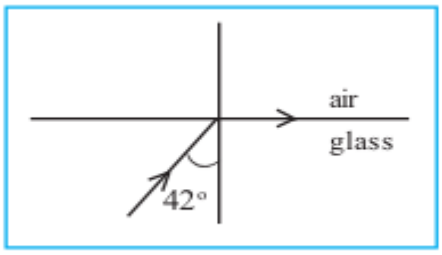

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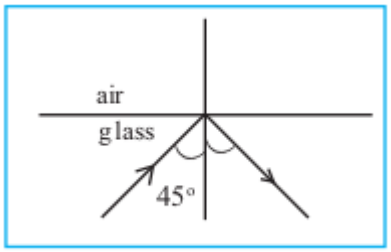


(e)

- Which are the figures that show total internal reflection? **Fig (a), and fig (e)**
- What is the critical angle of glass? **42^0**
- Will total internal reflection take place when light passing through water is incident on the surface of separation with air at an angle of incidence of 45^0? Why? **No. Critical angle of water is 48.6^0.Total internal reflection take place, when the angle of incidence is greater than critical angle.**

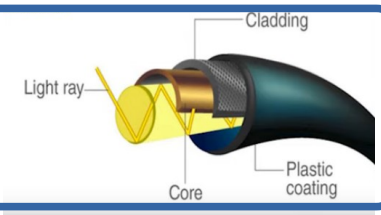
Activity 3

Find out the practical applications of total internal reflection in our day to day life?

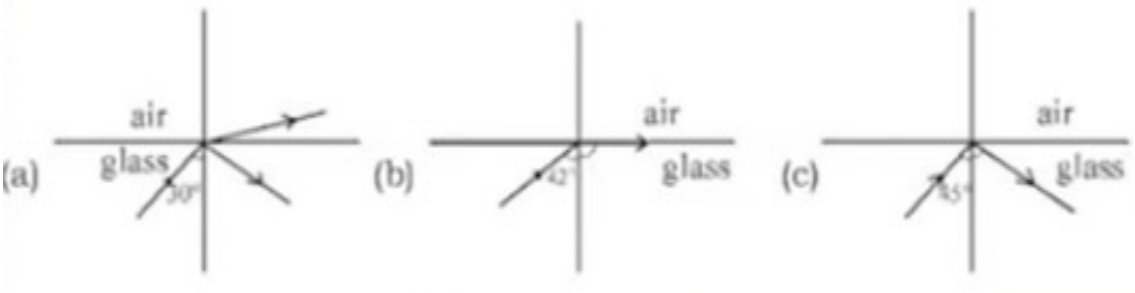
➔ Medical field → **Endoscope.**
➔ In the field of telecommunications → **Optical fibre cables.**

Optical fibre cables

Through optical fibres, thousands of signals of different frequencies can be sent to distant places simultaneously, making use of total internal reflection of light, without losing the intensity.



Assignment



Observe the figure and answer the following question.

1) What is the critical angle of glass?
2) Define critical angle?
3) Write the condition under which a light ray undergoes total internal reflection?
4) Write any two practical applications of total internal reflection in our day to day life?