CLASS-10 PHYSICAL SCIENCES

NEW TEXT BOOK

2014 - 2015

CHAPTER: 05 – REFRACTION OF LIGHT AT PLANE SURFACES

PERIOD PLAN-04 : Refraction – Snell's law

<table>
<tr><th>Content Analysis</th><th>Class Room Environment</th><th>Teaching Learning Material</th></tr>
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Refraction – Snell's law:
Imagine that a person has fallen out of boat at point B . The line marked through point 'X' is the shore line. We are at a point 'A' . To save the person we need to travel certain distance on land and certain distance in water.
we can run faster on land than we can swim in water. We have to travel a greater distance on the land.
For any speeds, One has to follow to reach the person is ACB, and that this path takes the shortest time. If we take any other route, it will be longer.
Let us consider a point 'D' on shore line which is very close to point 'C' such that there is essentially no change in time between path ACB and ADB.
First look at the paths on the land as , If we draw a perpendicular DE; between two paths at D, we see that the path (AD) on land is shortened by the amount EC. On the other hand, in the water, by drawing a corresponding perpendicular CF we find that we have to go the extra distance DF in water.
In other words, we gain a time that is equal to go through distance EC on land but we lose the time that is equal to go extra distance DF in water. These times must be equal since we assumed there no change in time between the two paths.
Let the time taken to travel from E to C and D to F be 't' and v_1 and v_2 be the speeds of running and swimming.
EC = $v_1 \Delta t$ and DF = $v_2 \Delta t$
EC / DF = v_1/v_2
Let i and r be the angles measured between the path ACB and normal NN, perpendicular to shore line X.
sin i = EC / DC and sin r = DF / DC
Therefore,
sin i / sin r = EC / DF
sin i / sin r = v_1 / v_2
We used the principle of least time to derive the above result. Apply the same for the light ray also.
sin i / sin r = n_2 / n_1
n_1 sin i = n_2 sin r. This is called **Snell's law**.
From the above discussion we can conclude that when light travels from one medium to another, the ratio of speeds v_1/v_2 is equal to n_2 / n_1.

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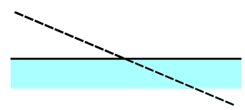
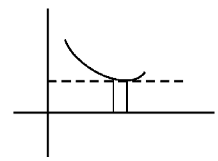
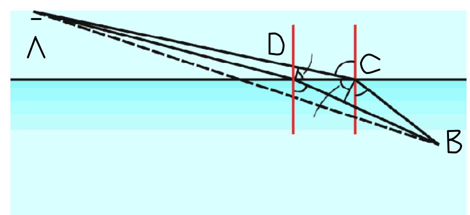
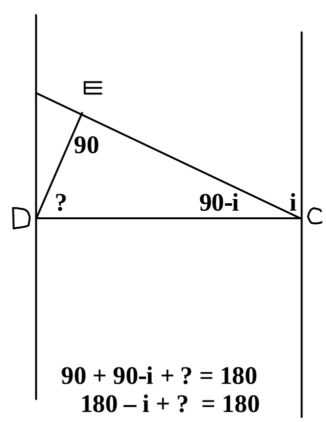
Conversation: About derivation of snell's law
Explanation: derivation of snell's law.









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Following are the laws of refraction:
1. The incident ray, the refracted ray and the normal to interface of two transparent media at the point of incidence all lie in the same plane.
2. During refraction, light follows Snell's law
n_1 sin i = n_2 sin r (or) sin i / sin r = constant.

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Conversation: About laws of refraction.

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