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Exp.6 - TOTAL INTERNAL REFLECTION - A

Aim: Investigation on Total Internal Reflection and determination of the refractive index of a mystery material using a simulation tool.

Online simulation link: https://phet.colorado.edu/sims/html/bending-light/latest/bending-light_en.html

PROCEDURE:

1. Go to simulation, Choose 'Intro'. The material in the top half should be **water**, the material in the bottom half should be **air**, and the angle of incidence set for minimum angle about 10°.
2. Keep increasing the angle of incidence until the angle of refraction is as close to 90°.
3. If you increase the angle of incidence further, then the refracted ray will disappear. The angle when this happens is called the "critical angle" for water. Record the critical angle for water in the table below.
4. Return the angle of incidence to 0° and change the material in the top half to glass. Repeat the procedure to record critical angle for glass.
5. Repeat the process to find the critical angle for material Mystery A.
6. Calculate the value of refractive index 'n' using the given equation.

Material	critical angle, C / degrees	sin (C)	n = 1/sin(C)
Water	50	0.76604	1.305407
Glass	42	0.66913	1.494476
Mystery A	25	0.42261	2.36620
Mystery B	45	0.707106	1.4142135

Result: The refractive index of the mystery material is found to be = 2.366201583

The name of the mystery material is (refer the below table) =

Assignment: Derive the equation for refractive index of unknown material n = 1/sin(C) using Snell's law in the below given space.

Let the refractive index of unknown material (top half) = $n_1 = n$

Let the refractive index of air = $n_2 = 1$

Acc. to Snell's law

$$n_1 \sin C = n_2 \sin 90^\circ$$

$$\Rightarrow n \sin C = 1 \times 1 \quad (\because \sin 90^\circ = 1)$$

$$\Rightarrow n = \frac{1}{\sin C}$$

Note: Students are instructed to use excel or Python for calculations and graph plotting. Submit the filled (manually) worksheet along with Excel/Python file in LMS for evaluation.