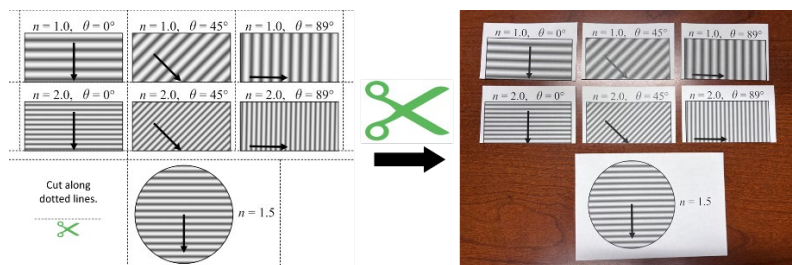


This document provides the instructions to prepare the refraction demonstration cards and how to use them to better understand refraction and total internal reflection (TIR).

Step 1 – Download the refraction demonstration card template from the course website.

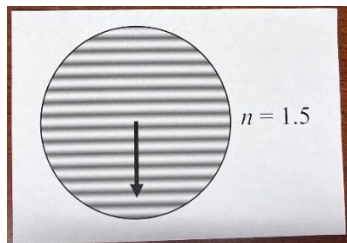
<https://empossible.net/wp-content/uploads/2023/01/Refraction-Cards.pdf>

Step 2 – Using scissors, cut out the refraction cards along the dotted lines as illustrated below.

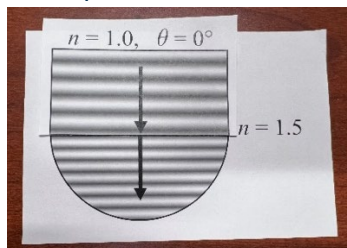


Step 3 – How to analyze refraction angles

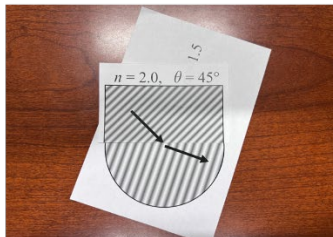
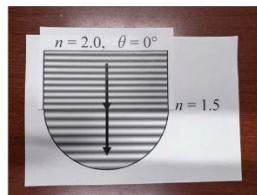
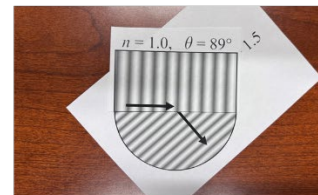
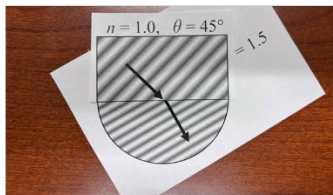
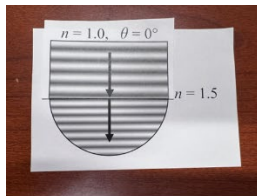
- (1) The square pieces show the wave inside of the incident medium (i.e. medium 1). The text label gives the refractive index of the medium and the angle of incidence. The bottom of these pieces will be the interface between mediums 1 and 2.
- (2) The circle piece shows the wave inside of the transmission medium (i.e. medium 2). The label gives the refractive index, but not the angle. It is up to you to rotate the circle piece to determine the angle of transmission.
- (3) Place the circle piece on a table so that the arrow points downward.



- (4) Place one of the square pieces over the top half of the circle piece so that the end of the arrow on the square piece approximately meets the start of the arrow on the circle piece.



- (5) While holding the square piece in a fixed position, rotate the circle piece about the center of the circle to experiment with different transmission angles. Keep the bottom of the square piece passing through the center of the circle to perfectly bisect it. Experiment with angles until the wave is continuous across the interface.



- (6) Only one angle will allow the field to be continuous. This angle is the angle of transmission that is calculated by Snell's law of refraction. If no angle can be found, the wave is cutoff in medium 2 and is completely reflected (i.e. total internal reflection occurs).