1. Total Internal Reflection
2. Image Formation by Refraction (plane surface)
3. Intro. to Lenses / Ray Tracing

\[ n_2 \sin \theta_c = n_1 \sin 90^\circ \]

\[ n_2 \sin \theta_c = n_1 \]

\[ \sin \theta_c = \frac{n_1}{n_2} < 1 \]

If \( \theta_{\text{incident}} > \theta_c \), no light gets out.

\( \rightarrow \) "Total Internal Reflection"
Your lecturer just drew the incorrect "refraction of light" sketch for light incident from air onto a blue glass plate, as shown below. What would you suggest to make it right?

1. Make $\theta_2$ smaller.
2. State that as drawn, $n_2 < n_1$.
3. Curve the ray in the lower medium.
4. Figure all angles from the perpendicular dotted line.
5. None of the above.

The light exits the same glass plate shown in the previous sketch. Select the direction that it will go when it exits the glass.

1. A
2. B
3. C
4. D
5. E
Several of your friends miss retrieving a gold happy face from the bottom of a stream on their first attempt. You dazzle everyone by drawing light rays illustrating that they were reaching in the wrong place. Which of the following sketches might you have drawn?

1. A
2. B
3. C

STOP TO THINK 34.3 A light ray travels from medium 1 to medium 3 as shown. For these media,

a. $n_3 > n_1$  
   b. $n_3 = n_1$  
   c. $n_3 < n_1$
   d. We can’t compare $n_1$ to $n_3$ without knowing $n_2$.
Image Formation by Reflection - Small Angles

\[ s' = \frac{s - n_2 c}{n_1} \]

Object distance

Image distance

\[ s' < 0 \]

\[ s' > 0 \]

Interface
No image formed at large angles.

\[ \theta_i = 55^\circ \]
\[ \theta_c = 48.75^\circ \]
Ray Diagram

(Thin) Lenses

\[ s' < 0 \quad s' > 0 \]

\[ \text{dist} = s' \]

F

Principle Axis

Principal Rays:
* Parallel Line (parallel to principal axis) will bend towards/away from focus

* Line through center keeps going

Guess the image is Real
(light rays actually form image)

A) Real and Inverted
B) Real and Upright
C) Virtual and Inverted
D) Virtual and Upright