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

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

\[ n_2 \sin \theta_c = n_1 \]

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

(starting in Nlower)

\[ \sin \theta_c = \frac{N_{\text{lower}}}{N_{\text{higher}}} \]

Critical angle \( \theta_c \) ("c" is for critical)

\( n_2 > n_1 \)

This light can't escape
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 Refraction - Snell's Law

$s' = \frac{n_2}{n_1} s$

Object (s)

Image

Virtual Image (light doesn't actually intersect here)

$n_2$

$n_1$

$s' > 0$

$s' < 0$

$x$

Answer: x = 1.33

$\text{ratio} = 1.00$
No image formed @ large angles

\( \theta_i = 55^\circ \)

\( \theta_c = 48.75^\circ \)
Principal Rays: *
- Parallel lines are bent towards/away from the focal point
- Ray through middle passes through unaffected

Image?

A) Real, Upright
B) Virtual, upright
C) Real, Inverted
D) Virtual, Inverted

Real: Light rays actually meet at image
Virtual: Light rays appear to originate from a point, but they don't actually start there.