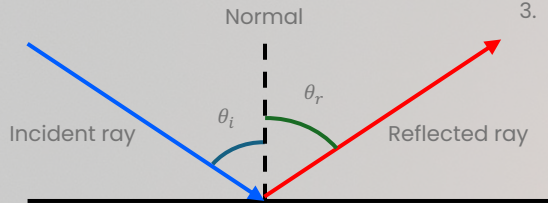


Reflection

Properties of light

- Light is an electromagnetic wave
- Light travels in straight lines
- Speed of light in vacuum = 3×10^8 m/s
- Slows down in optically denser mediums

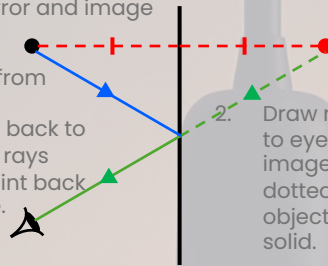


The law of reflection states that

- The incident ray, the normal, and the reflected ray all lie in the same plane
 - The angle of incidence is equal to the angle of reflection
- $$\theta_i = \theta_r$$

Reflection Ray Diagrams

1. Reflect object about mirror. Perpendicular distance should be equidistant between object, mirror and image



3. Draw ray from point of incidence back to object. All rays should point back to the eye.

2. Draw ray from image to eye. Rays on the image side should be dotted. Rays on the object side should be solid.

Reflected Image Properties

- Same size
- Same distance to mirror
- Upright
- Laterally inverted
- Virtual

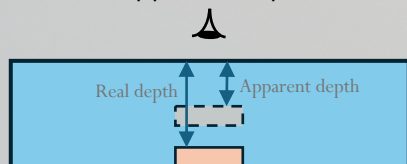
Refraction

- The refractive index is the ratio of the speed of light in vacuum to the speed of light in a medium

$$n = \frac{c_v}{c_m}$$

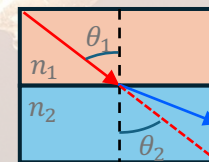
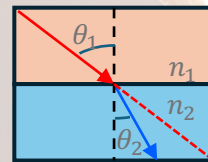
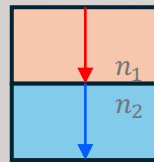
- Refraction refers to the change in direction of light due to the change in speed when entering a different medium
- Objects appear **shallower** due to refraction

$$n = \frac{\text{real depth}}{\text{apparent depth}}$$



Snell's Law

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$



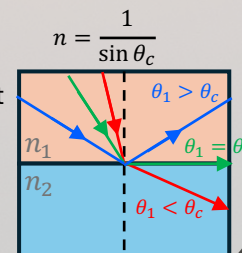
$\theta_1 = 0^\circ = \theta_2$
Incident normally
No refraction

$n_2 > n_1 \rightarrow \theta_2 < \theta_1$
Enters **denser** medium
Bends **towards** normal

$n_2 < n_1 \rightarrow \theta_2 > \theta_1$
Enters **less dense** medium
Bends **away** from normal

Critical Angle & TIR

- The critical angle is defined as the angle of incidence such that the angle of refraction is 90° for a light ray entering a less dense medium
- Rays incident at greater than the critical angle undergo Total Internal Reflection



Key Concepts And Ideas

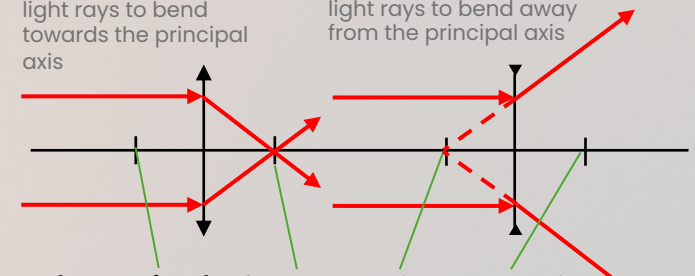
Light

Lenses

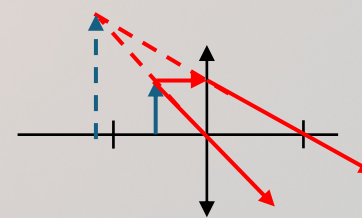
Lens Properties

Converging lenses cause light rays to bend towards the principal axis

Diverging lenses cause light rays to bend away from the principal axis



The **focal point, f**, refers to the point where all light rays converge to upon emerging from the lens



Object distance < f

- Image is
- Magnified
 - Upright
 - Virtual

Object distance > f

- Image is
- Inverted
 - Real

