

Reflection

Unit: Light & Optics

NGSS Standards/MA Curriculum Frameworks (2016): N/A

AP® Physics 2 Learning Objectives/Essential Knowledge (2024): 13.1.A, 13.1.A.1, 13.1.A.1.i, 13.1.A.1.ii, 13.1.A.1.iii, 13.1.B, 13.1.B.1, 13.1.B.2, 13.1.B.3, 13.1.B.4

Mastery Objective(s): (Students will be able to...)

- Explain why light is reflected off smooth surfaces.

Success Criteria:

- Descriptions & explanations account for observed behavior.

Language Objectives:

- Explain why light is reflected off smooth surfaces.

Tier 2 Vocabulary: light, reflection, virtual image, real image

Labs, Activities & Demonstrations:

- full length mirror on the wall (does amount of image visible change with distance?)
- Mirascope (“hologram maker”)

Notes:

reflection: when a wave “bounces” off an object and changes direction.

specular reflection: reflection from a smooth surface.

diffuse reflection: reflection from a rough surface.

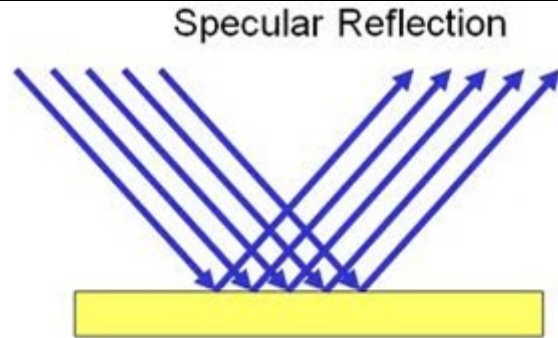
virtual image: a perceived image that appears to be the point of origin of photons (rays of light) that diverge. Because light is reflected back from a mirror (*i.e.*, light cannot pass through it), a **virtual image** is one that appears **behind** (or “inside”) **the mirror**. A virtual image is what you are used to seeing in a mirror.

real image: a reflected image that is created by photons (rays of light) that converge. Because light is reflected back from a mirror (*i.e.*, light cannot pass through it), a **real image** is one that appears **in front of the mirror**. A real image created by a mirror looks like a hologram.

A rule of thumb that works for both mirrors and lenses is that a real image is produced by the convergence of actual rays of light. A virtual image is our perception of where the rays of light appear to have come from.

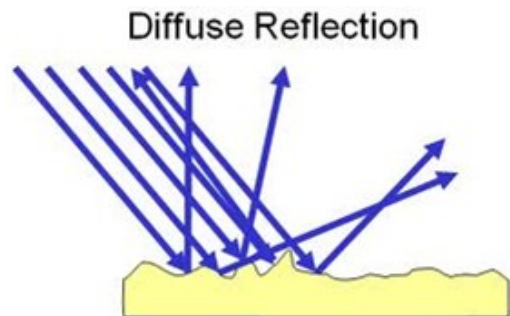
Specular reflection: reflection from a smooth surface, such as a mirror.

If the photons of light from the source are parallel when they strike the surface, they will also be parallel when they reflect from the surface. This results in a reflected image that appears to be the same size, shape, and distance from the surface as the original object.



Diffuse reflection : reflection from a rough surface, such as a wall.

Light striking a rough surface will illuminate the surface. However, because the reflected light rays are not parallel, the reflected light does not create a reflected image of the object.



mirror: a surface that causes specular reflection. An object that was not made to be a mirror but behaves like one is often called a mirrored surface.

When light waves strike a mirrored surface at an angle (measured from the perpendicular or “normal” direction), they are reflected at the same angle away from the perpendicular. The most common statement of this concept is “The angle of incidence equals the angle of reflection.”

This can be stated mathematically as either $\theta = \theta'$ or $\theta_i = \theta_r$.

