The Ray Model of Light

- **Geometric optics:** the use of light rays to determine the path of light when it strikes an object.
- **Light ray**: a line and arrow representing the direction and straight-line path of light.

Define the following terms:

- Incident Light
- Mirror
- Light Ray
- Transparent
- Translucent
- Opaque
- Image
- Reflection

- **Incident light**: the emitted light from a source hitting the object.
- **Mirror**: any polished surface that exhibits reflection
- **Transmitted**: light passes through a substance, called a medium

- **Reflected**: when light bounces off of an object, this is what our eyes see from non-luminous objects. White objects and Mirrors reflect most of light that hits them.

- **Absorbed**: light energy is absorbed into the substance. Anything black absorbs most of the light that hits it. It will transfer the light energy into heat energy.

- **Translucent**: substance that transmits some of the light
- **Transparent**: substance that transmits all of the light through it
- **Opaque**: substance that does not transmit any light through it

Fact: a thickness of water greater than 150 m is opaque

- **Shadows**: are dark areas that form behind an object that is being illuminated more brightly on one side than on any other.

- **incident ray**: the incoming ray that strikes a surface
- **reflected ray**: the ray that bounces off a reflective surface
- **normal**: the perpendicular line to a mirror surface (at right angles or 90 degrees from the reflected surface)

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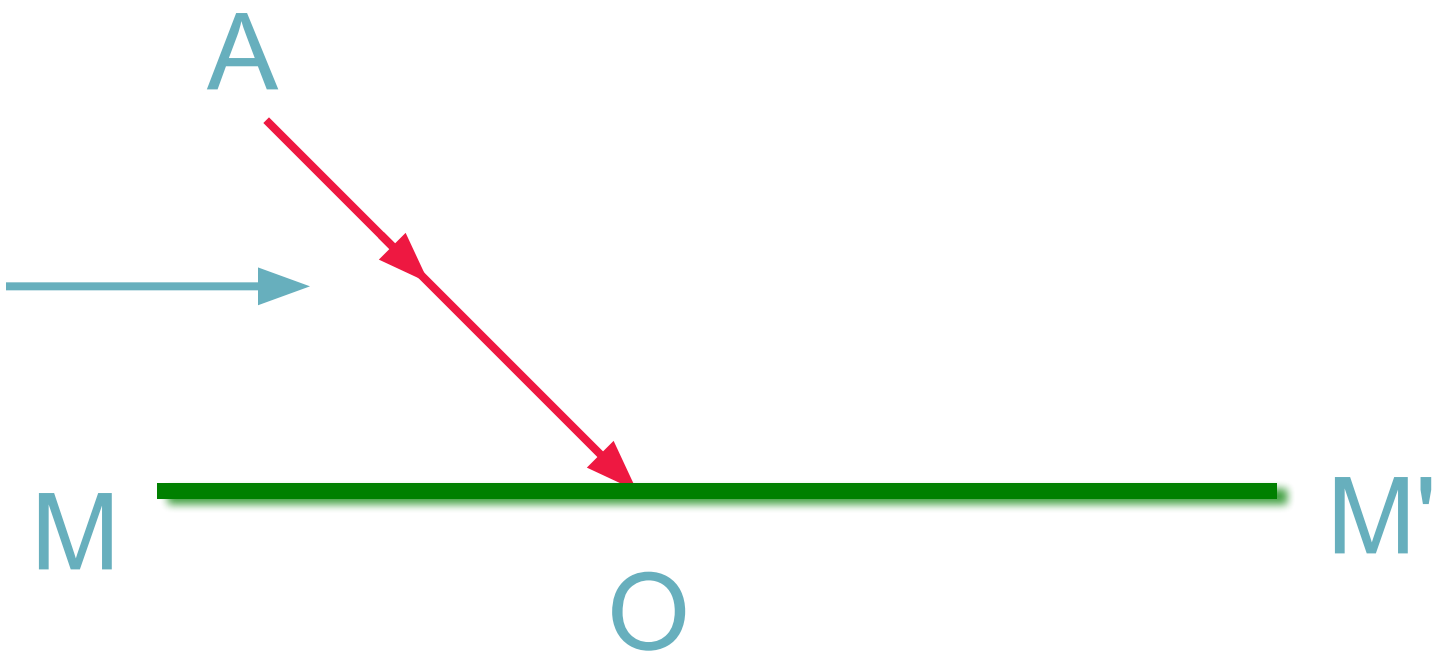
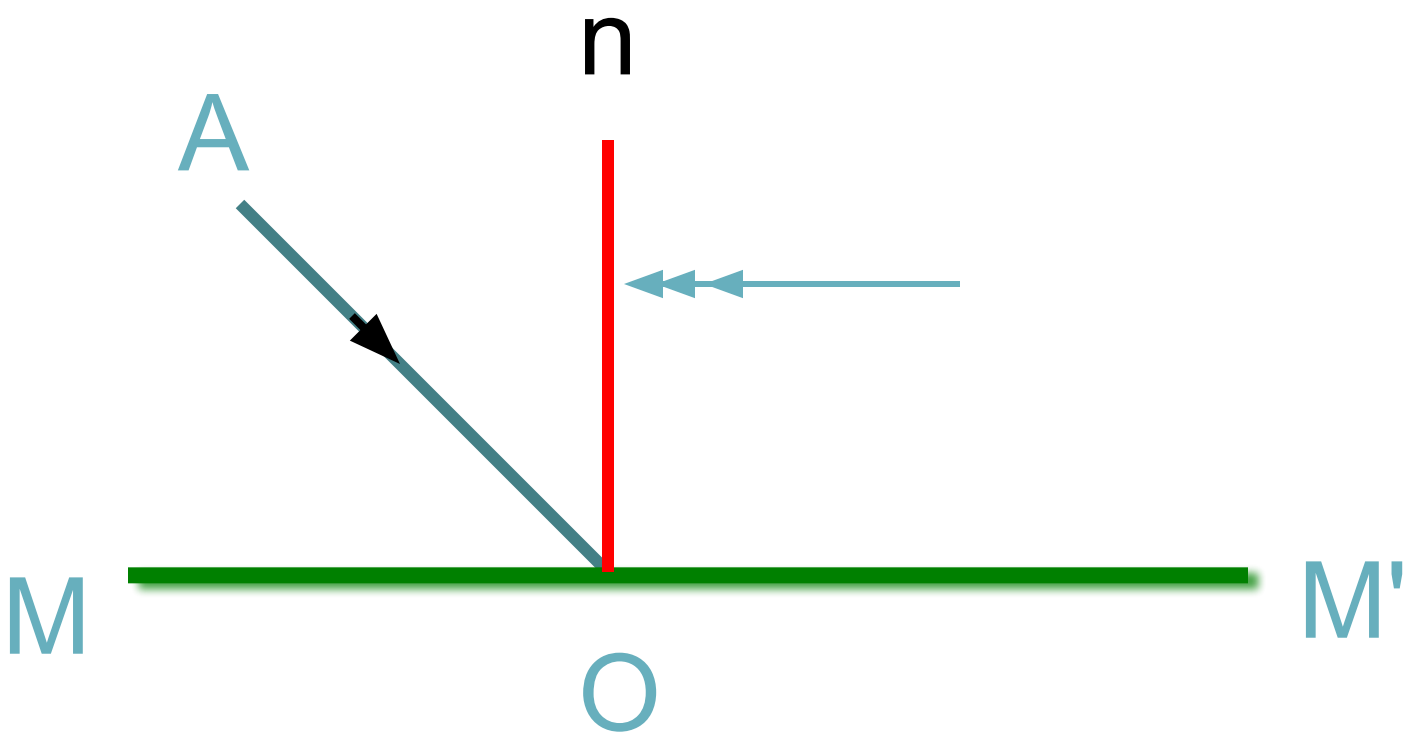
Incident Ray

- **A ray which represents the incident (or incoming) light is an incident ray.**



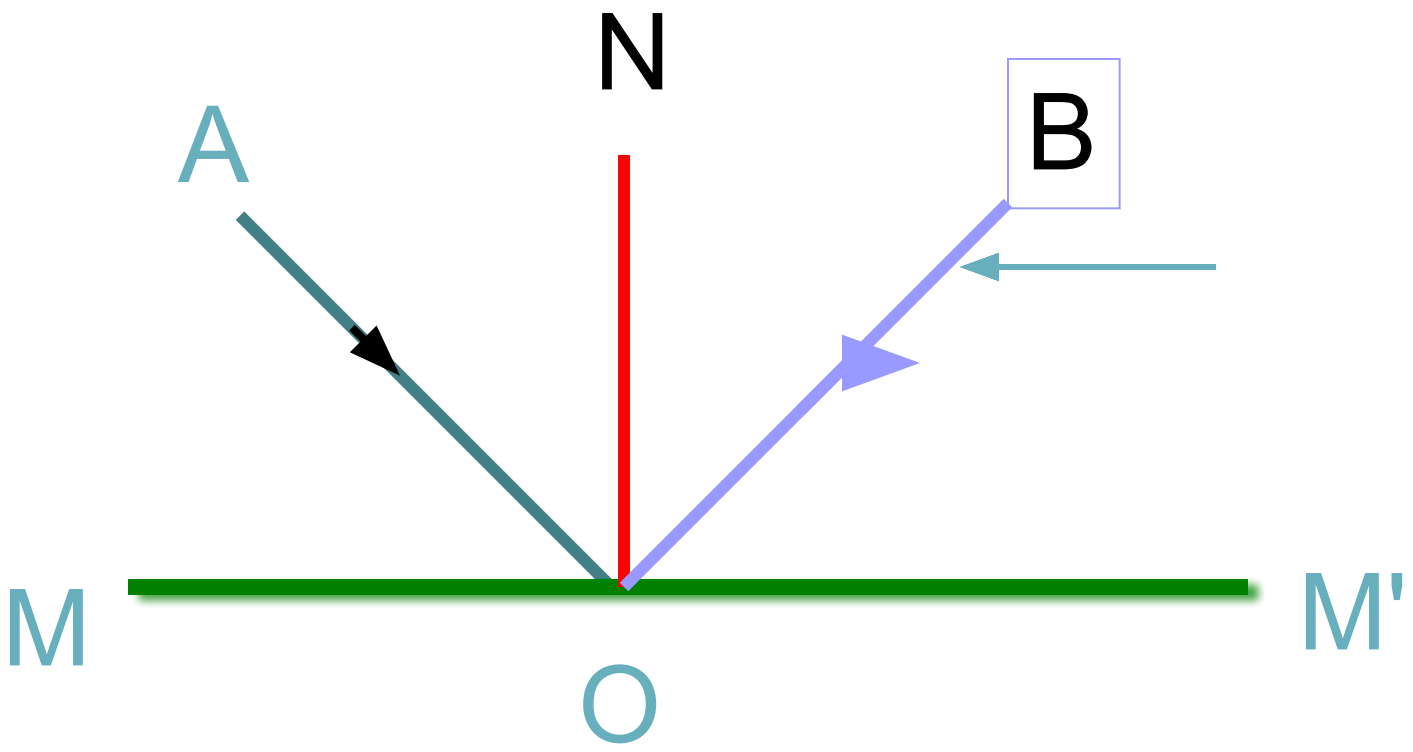
Normal

- **A line perpendicular to the surface at the point of incidence is called a normal (n).**



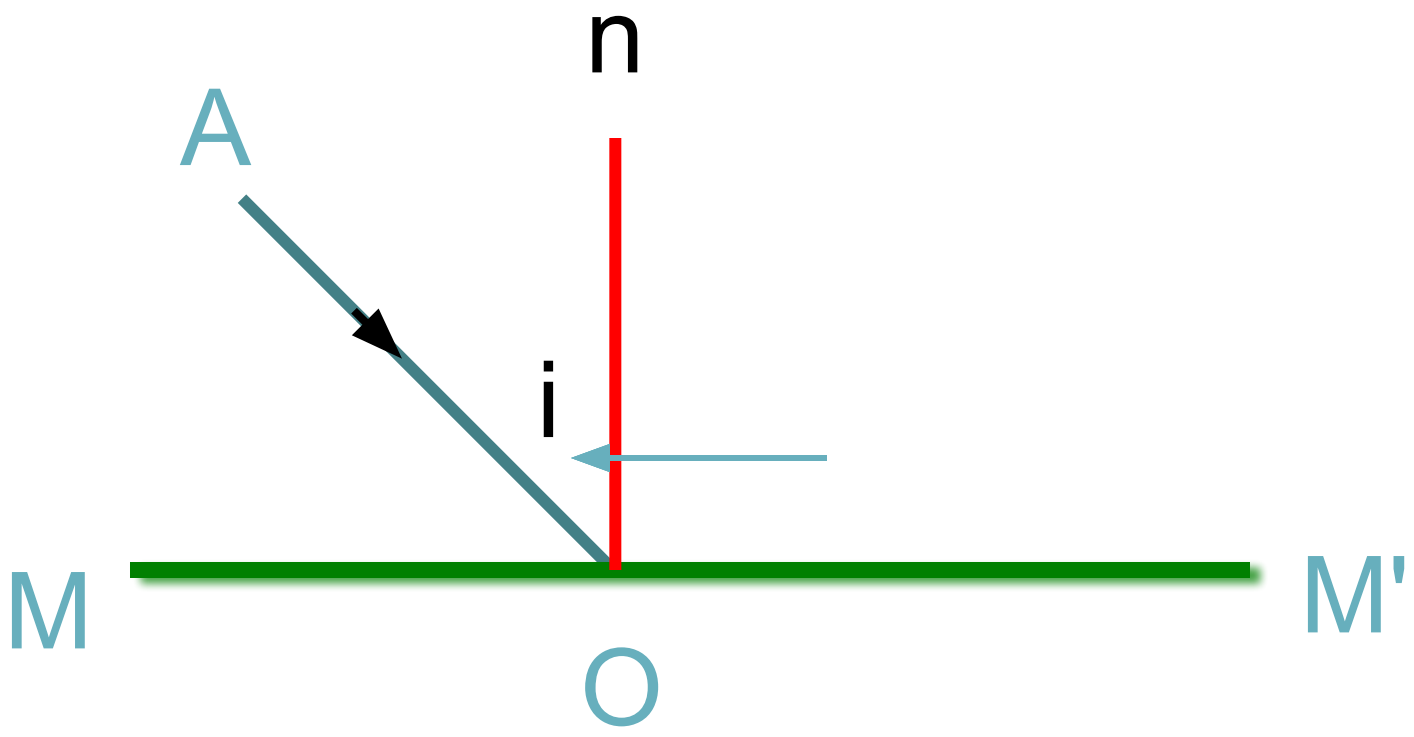
Reflected Ray

- **A ray which represents the reflected (or outgoing) light is a reflected ray.**



Angle of Incidence

- **An angle between the incident ray and the normal is called an angle of incidence.**



Angle of Reflection

- **An angle between the reflected ray and the normal is an angle of reflection.**

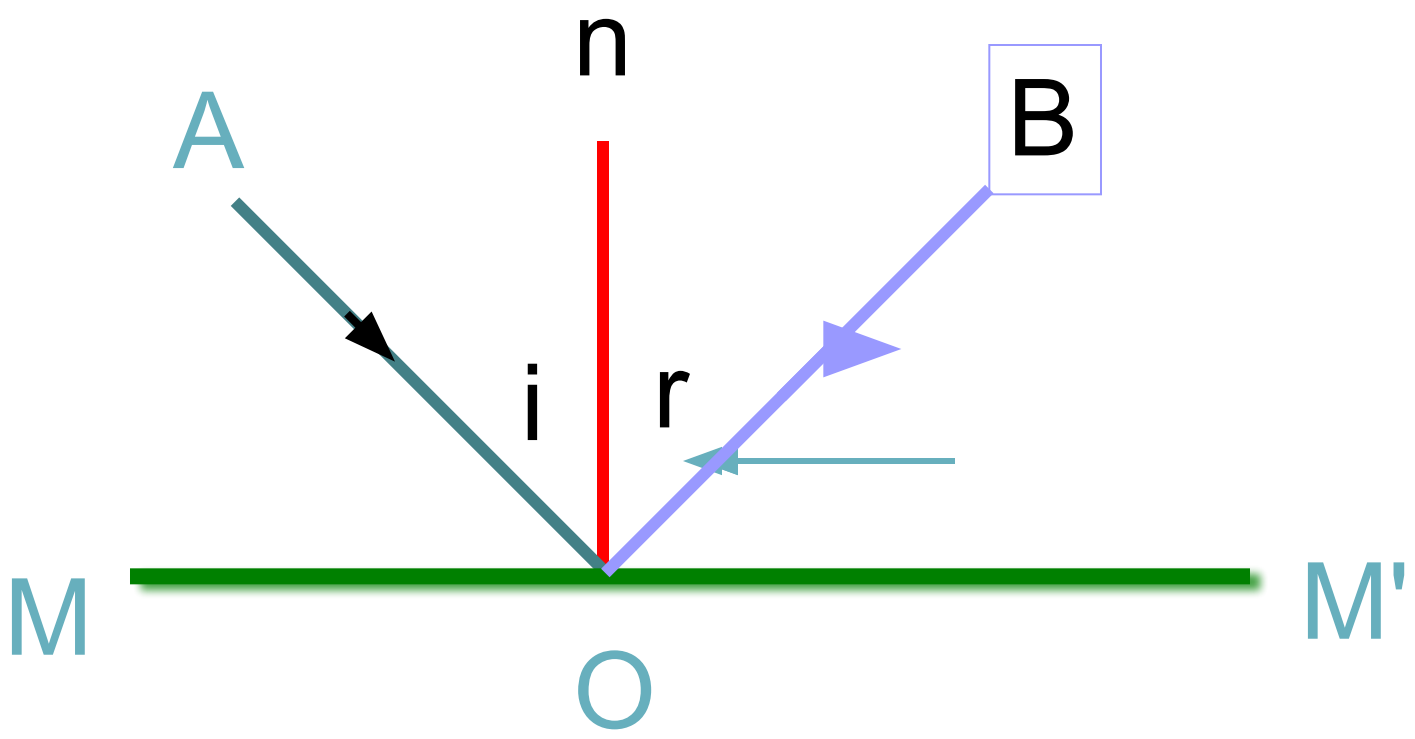
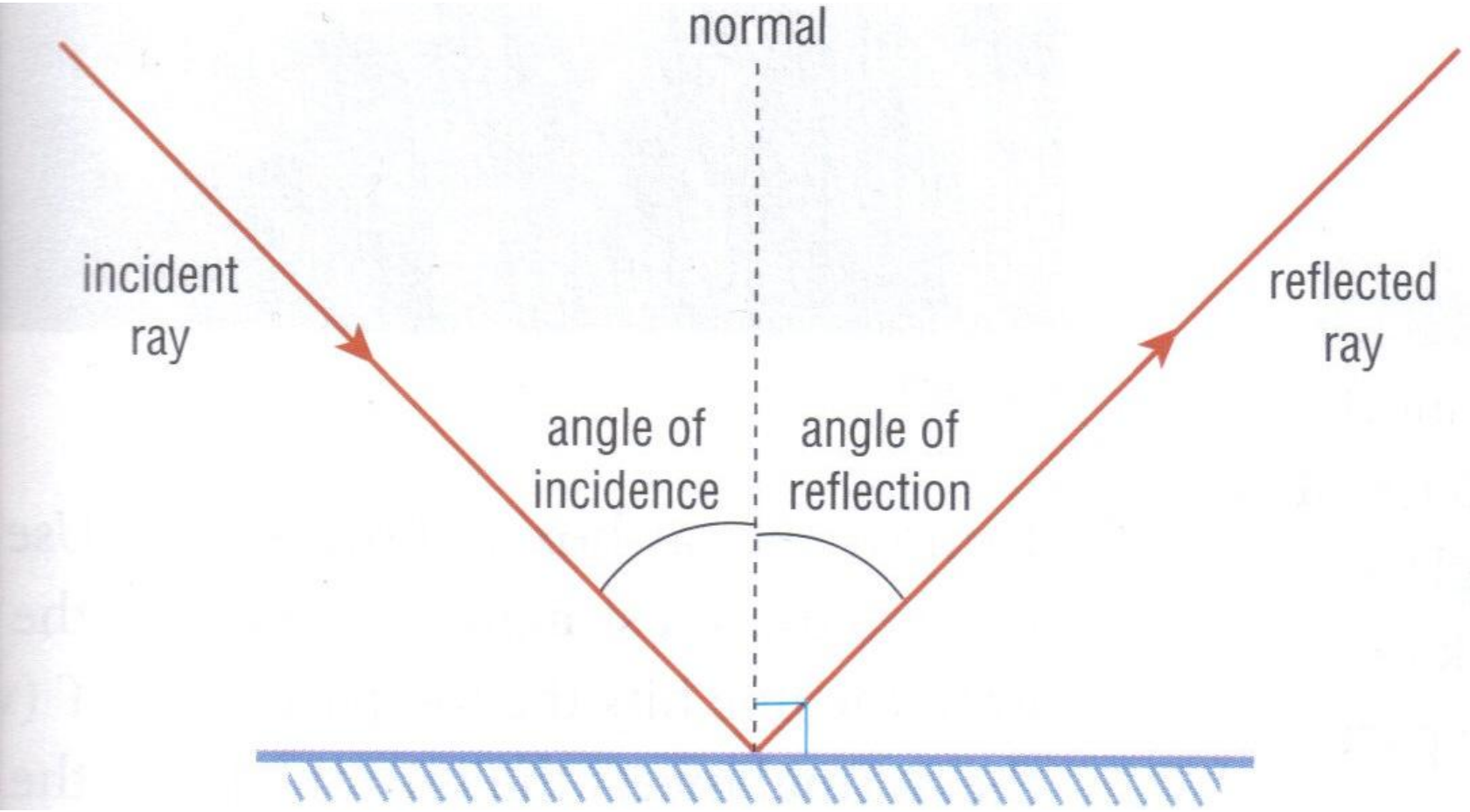
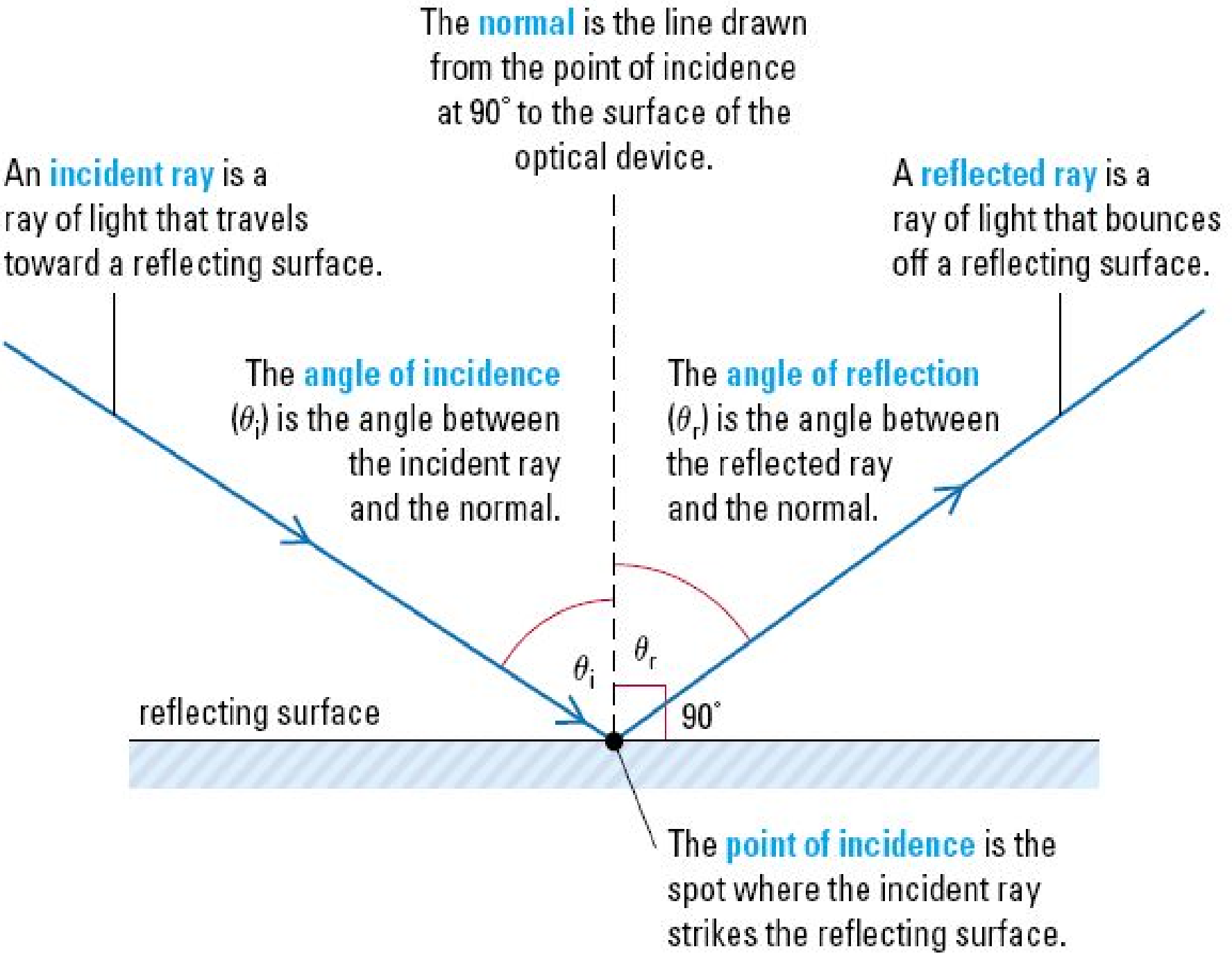
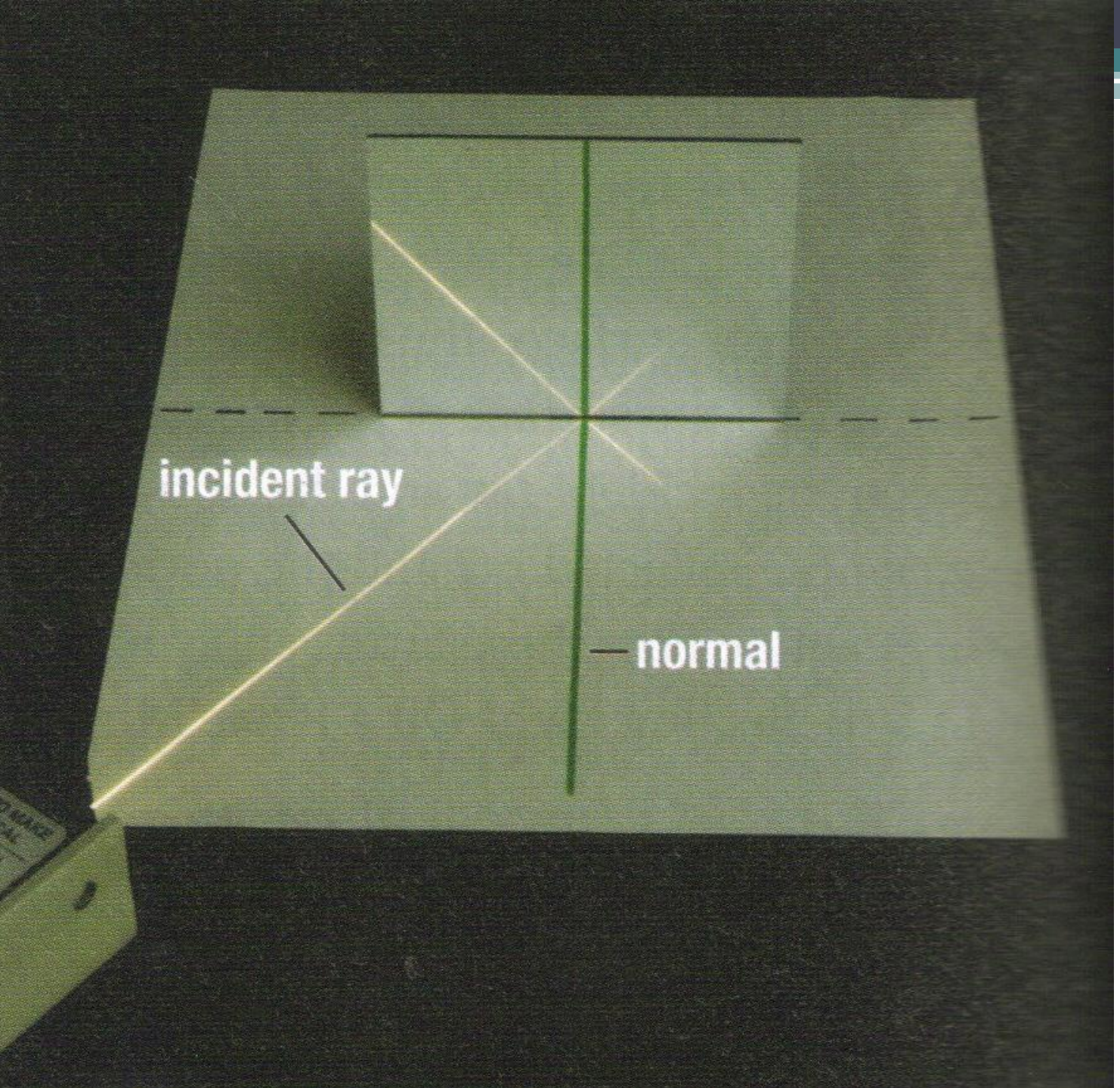


Figure 6 Terminology for reflection off a plane mirror




The normal is the line drawn from the point of incidence at 90° to the surface of the optical device.
An incident ray is a ray of light that travels toward a reflecting surface.
A reflected ray is a ray of light that bounces off a reflecting surface.
The angle of incidence (θ_i) is the angle between the incident ray and the normal.
The angle of reflection (θ_r) is the angle between the reflected ray and the normal.
θ_i
θ_r
reflecting surface
90°
The point of incidence is the spot where the incident ray strikes the reflecting surface.



Ray box and Mirror

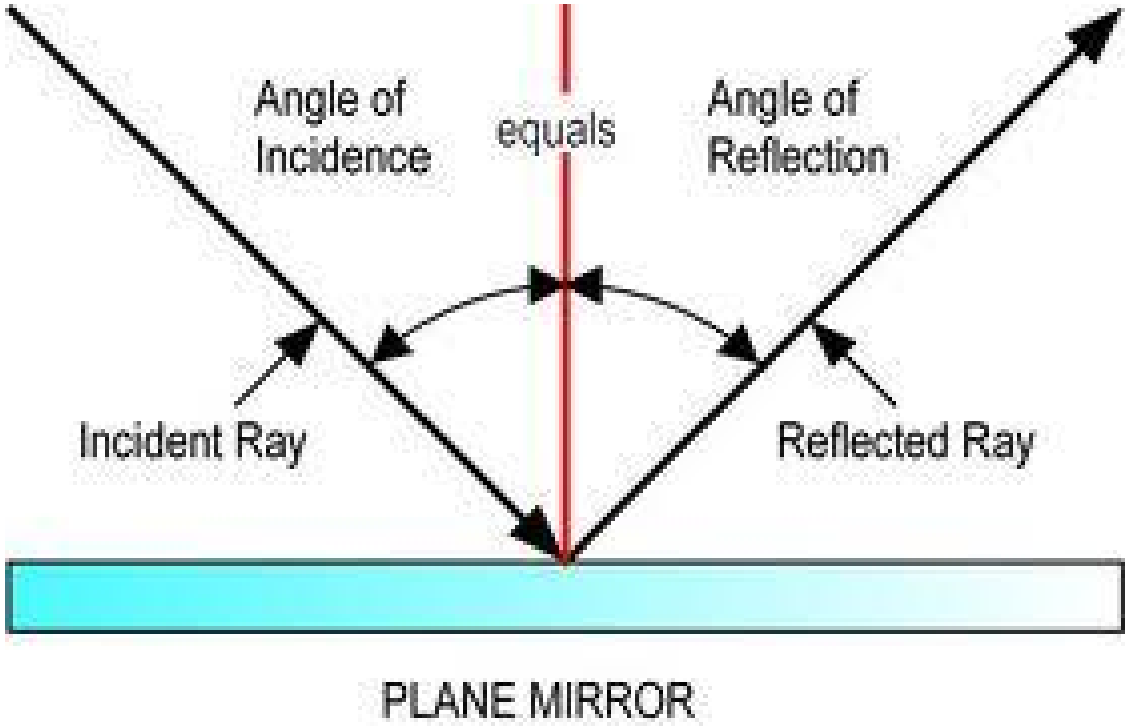
Discover the Law of Reflection

- Take a mirror, laser and protractor

- Draw a line across the surface of the mirror
- Draw a normal to this line
- Draw a line that intersects the normal and mirror surface at a random angle
- Shine your laser along the line
- Trace the light ray coming off of the mirror
- Measure θ_i and θ_r and place values in a chart
- Repeat for a total of 5 trials
- Make a conclusion based on your data

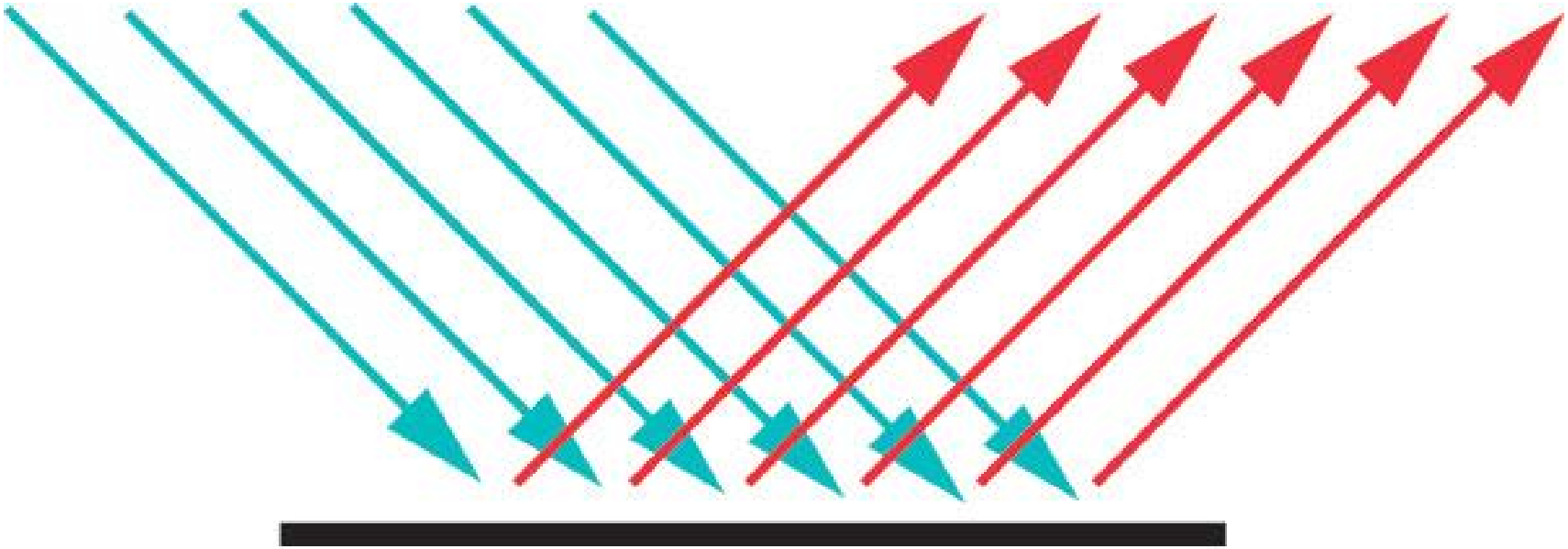
Law of Reflection

1. The angle of incidence equals the angle of reflection
2. The incident ray, reflected ray and the normal all lie on the same plane



Specular Reflection

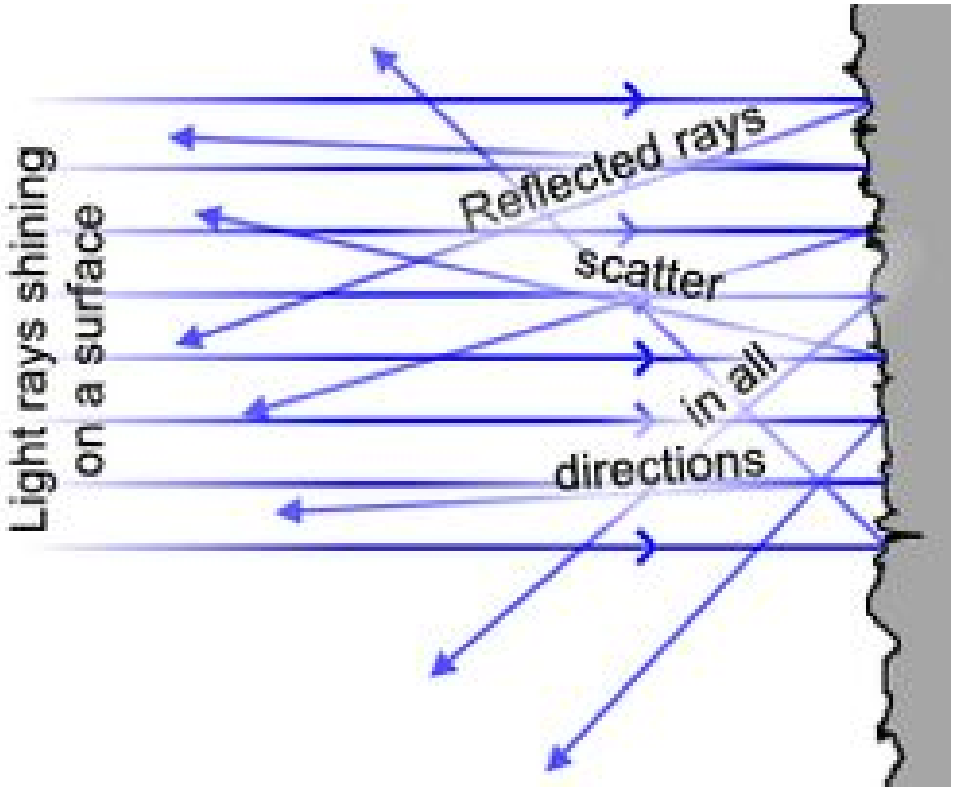
- Specular reflection – reflection of light off of a smooth, shiny surface



Specular Reflection
(smooth surfaces)

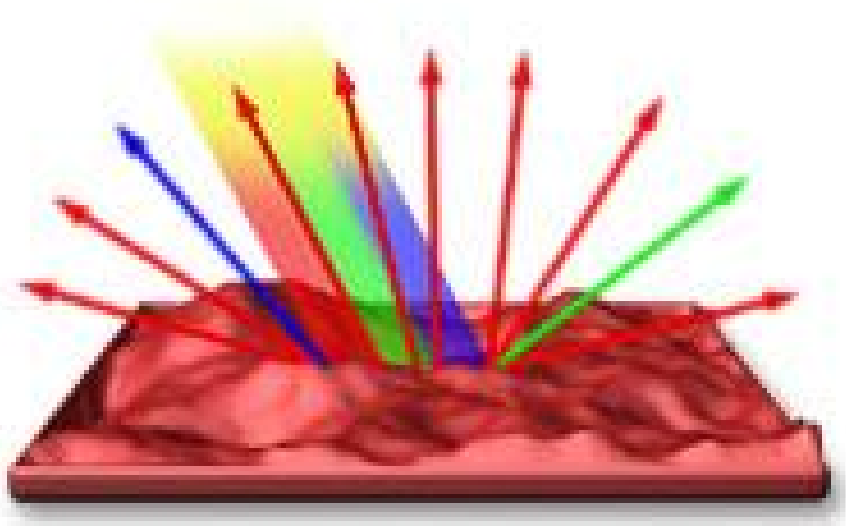
Diffuse Reflection

- Results from the reflection of light off of a dull or irregular surface



Specular and Diffuse Reflection

Specular Reflection



Diffuse Reflection