

## HISTORICAL PERSPECTIVE

Ancient Times	Chinese	used mirrors
	Archimedes	used mirrors in war
	Pythagoras	thought light was beams of light coming from our eyes
1 <sup>st</sup> Century	Euclid	light is reflected travels in straight lines
	Ptolemy	light bends when it travels from air to glass
1000 AD	Al-Haythem	first to accurately describe how vision worked
1670	Isaac Newton	light is a mixture of different colors of light
1676	Ole Romer	determined the speed of light

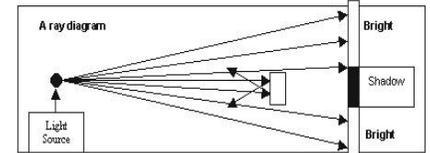
## OPTICAL DEVICES

1300 AD	Alessandra della Spina	wore the 1 <sup>st</sup> pair of eyeglasses
1595	Zacharias Jansen	built the 1 <sup>st</sup> microscope
1600's	Antonie van Leeuwenhoek	discovery of cells using a very simple microscope
	Galileo Galilei	invented the <b>refracting</b> telescope
1670	Isaac Newton	invented the <b>reflecting</b> telescope
	Ignatio Porro	prism erecting system (simple binoculars)
1900	1 <sup>st</sup> Endoscope Hubble Space Telescope	

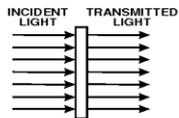
## PROPERTIES OF LIGHT

- Light travels in straight lines
- Light can be reflected
- Light can be bent
- Light is a form of Energy

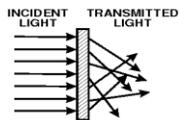
A ray is a straight line that represents the path of a beam of light. Ray diagrams help to demonstrate brightness or intensity of light through changes in distance. The ray model helps to explain how shadows can be formed when an object blocks the ray of light.



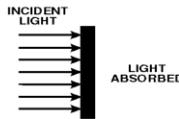
## LIGHT INTERACTIONS



A. TRANSPARENT



B. TRANSLUCENT



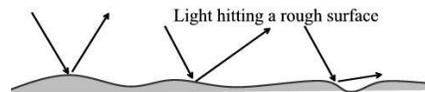
C. OPAQUE

**Transparent** - light passes through it undiffused, you can see clearly the details of whatever is on the other side (a **glass window is transparent**).

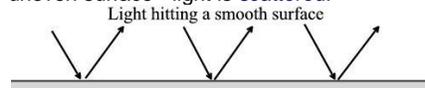
**Translucent** - light passes through but is diffused, you cannot see clearly details on the other side (a **frosted glass window is translucent**).

**Opaque** - no light passes through, you can see nothing through it at all (a **door is opaque**).

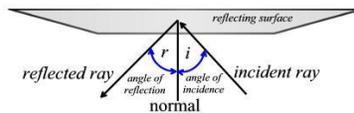
## LAW OF REFLECTION



**Diffuse reflection** occurs as light hits an uneven surface - light is **scattered**.

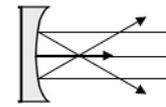


**Regular reflection** occurs as light hits a smooth surface, the light reflects at an opposite angle to the angle it hits.

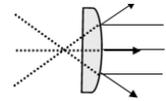


The **Law of Reflection** states that **the angle of incidence equals the angle of reflection when light reflects off a smooth surface**

## MIRRORS



**Concave mirrors form an image that appears to be closer than it actually is and can be useful because it can also reflect light from a large area**  
**rear-view mirrors and side mirrors on automobiles**



**Convex mirrors form images that appear much smaller and farther away than the object - but they can reflect light from a large area**  
**security devices, flashlights, telescopes, cosmetic mirrors and car headlights**

## LAW OF REFRACTION

**Refraction** is the process in which light is bent, when it travels from one medium to another. Light bends because it changes speed when it moves through materials that have different densities. The bending of light makes the object's image appear to be in a different position than it really is.

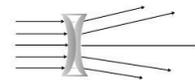
The **Law of Refraction** states that when light travels from one medium, to a more dense medium, the light will be bent **toward** the normal, and when it exits the denser medium into a less dense medium it will bend **away** from the normal. The new direction of light is called the **angle of refraction**.

Light travels **slower** in materials that are denser, because there are more particles.

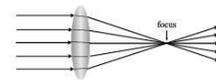
The refraction of light through air is called a **mirage**.

## LENSES

A **lens** is a curved piece of transparent material (glass/plastic). When light rays pass through it, the light is refracted, causing the rays to bend.



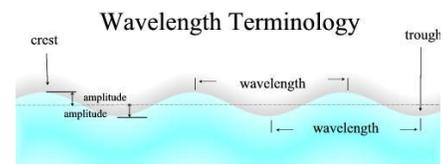
A **double concave lens** is thinner and flatter in the middle than the edges. Light passing through the thicker more curved areas of the lens will bend more than light passing through the thinner areas, causing the light to spread out or **diverge**.



A **double convex lens** is thicker in the middle than around the edges causing the light to come together at a focal point, or **converge**.

## WAVE MODEL OF LIGHT

The **wave model of light** describes light traveling as a **wave**. It doesn't explain everything about how light behaves but it helps us visualize it.



The high parts of the wave are called **crests**. The low parts of the wave are called **troughs**. The distance from crest to crest is called **wavelength**. The height of the crest or the depth of the trough from rest position is called the **amplitude**. **Frequency** is the rate at which the crests and the troughs move up and down.