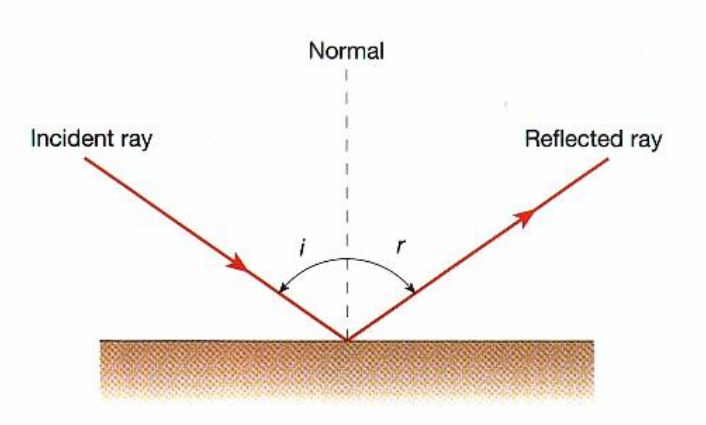
PROPERTIES OF WAVES

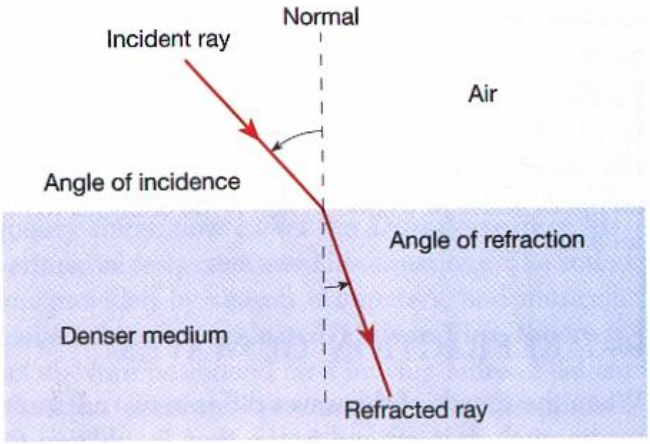
Reflection

- When waves encounter a ***barrier***, some ***reflection*** occurs.
- ***Echo*** is reflection of ***sound*** waves ; ***image*** is reflection of ***light*** waves.
- The ***Law of Reflection*** states that the ***angle of incidence*** is equal to the ***angle of reflection***.



Refraction

- When light waves encounter a **transparent medium**, some is **reflected** and some is **transmitted**.
- The transmitted light **changes speed and direction**, and **bends** as a result.
- **Bending of light** due to a **change in speed** is called refraction



INDEX OF REFRACTION

- ***Index of refraction*** is the ***ratio*** of speeds of light in two ***media***.

$$\textbf{Index of refraction} = \frac{\textbf{velocity of light in vacuum}}{\textbf{velocity of light in medium}}$$

$$\mathbf{n = \frac{c}{v}}$$

- Speed of light in vacuum has been measured to be 3.0×10^8 m/s.
- Since light travels fastest in vacuum, the ***index of refraction*** is always ***greater than 1***.

Examples:

1. Ice has an index of refraction of 1.305. What is the velocity of light in ice?

   n =

   c =

   v = ???

2. Water has an index of refraction of 1.33. What is the speed of light in water?

   n =

   c =

   v =

3. The speed of light in glass is 2.0×10^8 m/s. What is the index of refraction of glass?

   n =

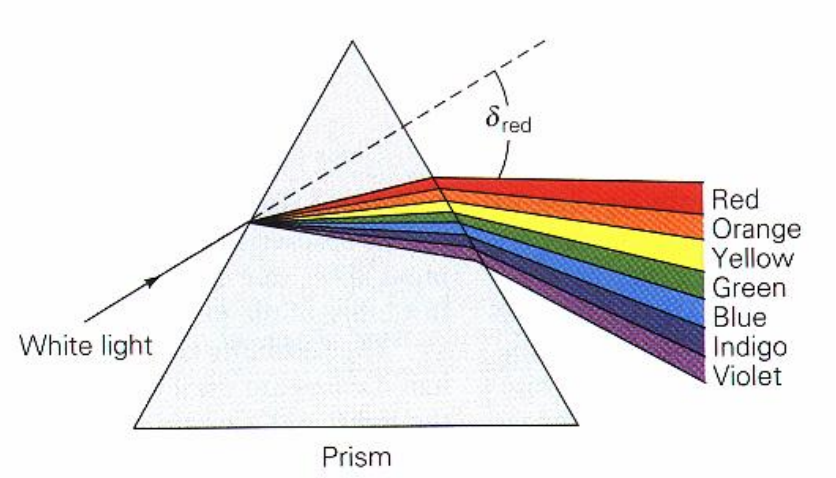
   c =

   v =

DISPERSION / DIFFRACTION

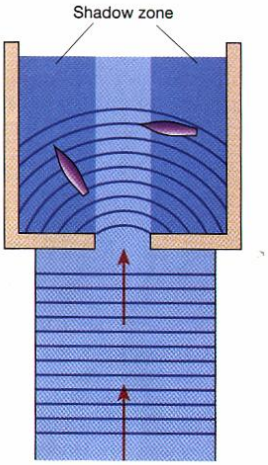
Dipersion

- When ***white light*** is passed through a glass ***prism***, it is ***dispersed*** into a spectrum of ***colors***.



- As ***each wavelength*** of visible light enters the prism, it ***refracts differently***.
- The ***longest*** wavelength (***red***) refracts the ***least***, and the ***shortest*** wavelength (***violet***) refracts the ***most***.

Diffraction

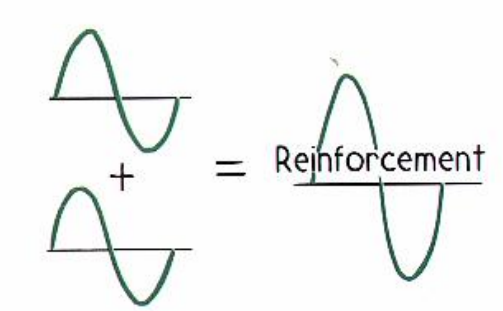


- ***Bending*** of waves around ***obstacles*** is called ***diffraction***.
- **Waves passing through 1 or 2 slits near one another create a unique pattern due to diffraction**
- ***Sound*** can be heard around corners, and ***light*** can be seen through openings due to ***diffraction***.

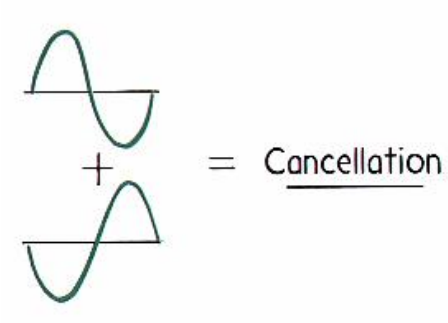
INTERFERENCE

- When two waves occupy the same space, ***interference*** occurs.

- ***Constructive*** interference occurs when the waves are ***in phase***, i.e. their crests and troughs are aligned similarly. As a result, ***reinforcement*** of the waves occurs.

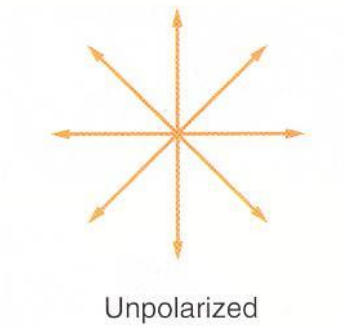


- ***Destructive*** interference occurs when the waves are ***out of phase***, i.e. their crests and troughs are aligned opposite of each other. As a result, ***cancellation*** of the waves occurs.

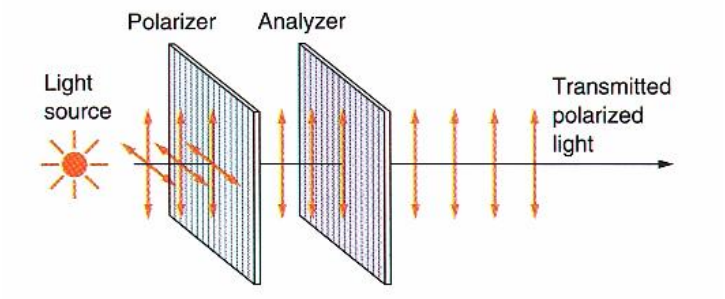


POLARIZATION

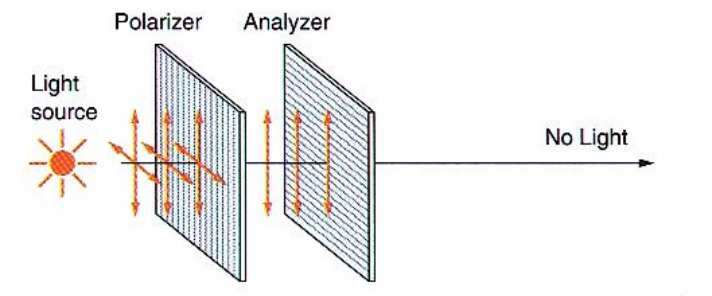
- ***Refraction*** and ***interference*** are evidence that ***light*** is ***wavelike*** in nature.
- ***Polarization*** of light is evidence that light is a ***transverse*** wave.
- A transverse wave can be ***generated*** along different ***planes***. Such wave is called ***unpolarized)***.



- When unpolarized light is ***passed*** through a ***Polarizer*** , only the waves in the ***direction of the filter*** can ***pass*** through (c).

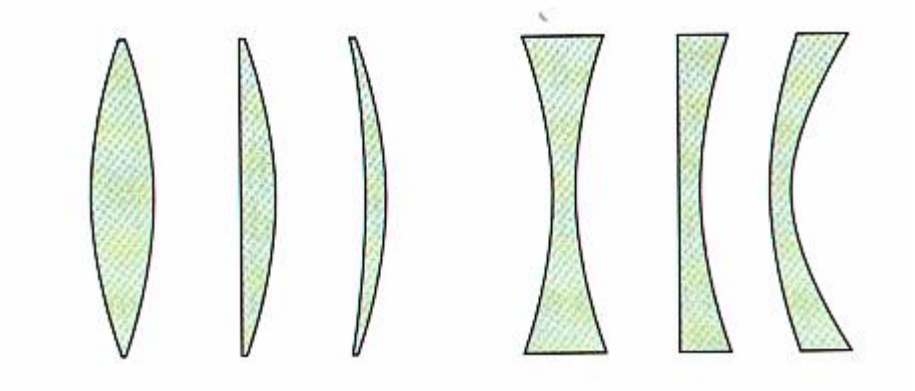


- When ***two polarizing filters*** are aligned , the ***amount of light*** transmitted through depends upon their ***alignment***.



SIMPLE LENSES

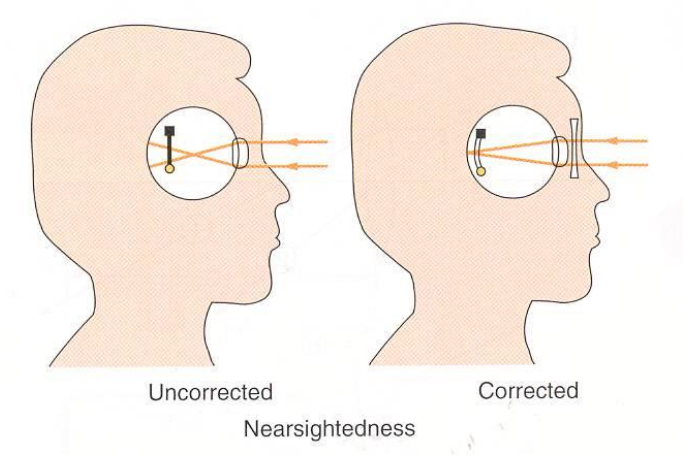
- A practical effect of ***refraction*** occurs in ***lenses***.
- Two types of lenses:



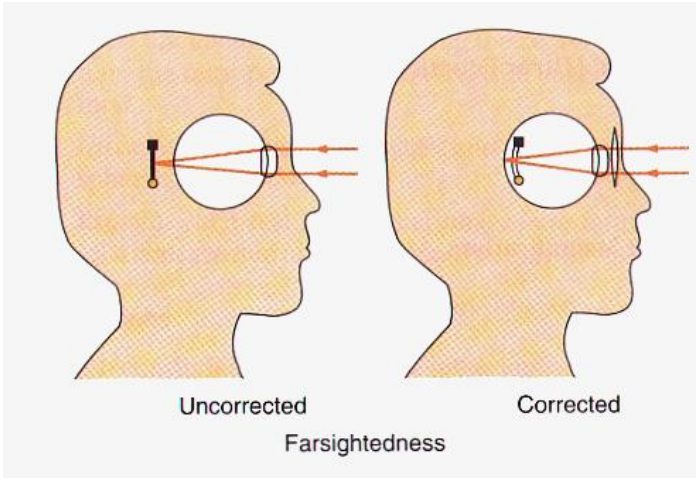
Convex or ***Converging***	***Concave*** or ***Diverging***
• ***thicker*** at ***center*** than edges	• ***thinner*** at ***center*** than edges
• refracted rays ***converge*** at a point	• refracted rays ***diverge*** from a point
• light waves slow down more through the center of lens	• light waves slow down more at the edges

VISION CORRECTION

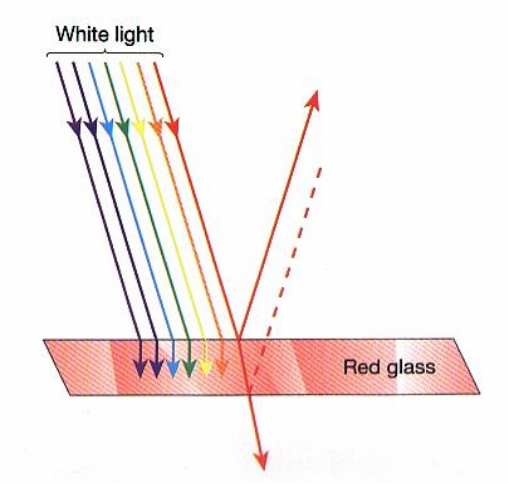
- ***Nearsightedness*** occurs when ***image*** is formed in ***front*** of the ***retina***. This condition is corrected by wearing glasses with ***diverging*** lenses.



- ***Farsightedness*** occurs when ***image*** is formed ***behind*** the ***retina***. This condition is corrected by wearing glasses with ***converging*** lenses.



COLOR



- ***Colors*** of most objects are due to ***selective reflection*** and ***absorption*** of light by a material.
- The ***red glass*** appears red because it ***transmits*** the ***red*** component present in white light, and ***absorbing all other colors***.
- When light rays are ***reflected*** from the top and bottom surfaces of a ***thin film*** (soap bubble, oil film, etc.), ***constructive*** and ***destructive interference*** occurs. As a result, a variety of color is visible to the observer.