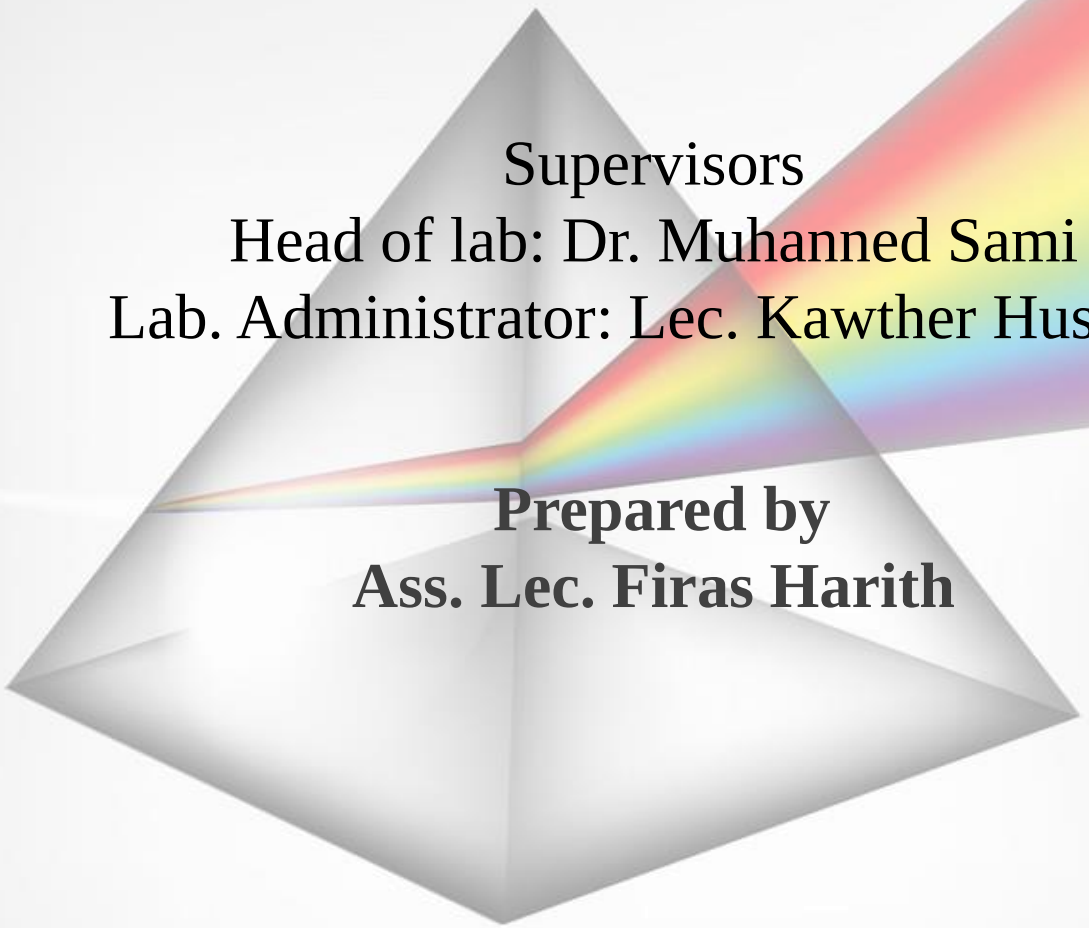
Correlation Between Light Intensity and Distance



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Light Nature

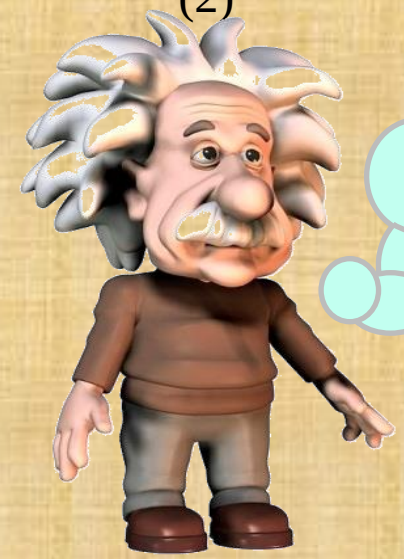
Light nature is much more difficult to understand than that of sound.

No Sir Newton Light must be a wave

(2)

Light was comprised of tiny mass-less particles

(1)



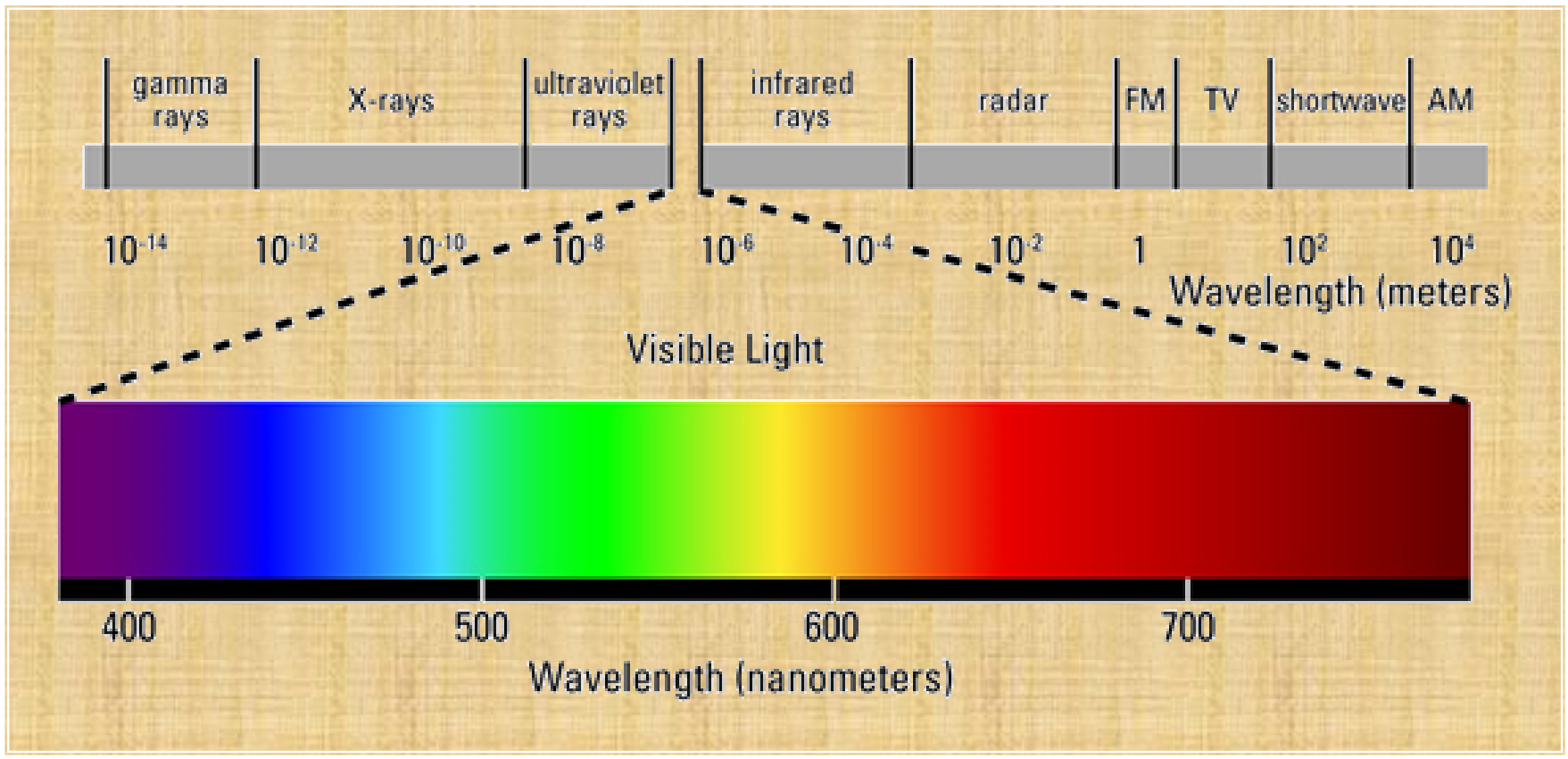
My friends all of you are right... Light has both particle properties and electromagnetic wave properties.

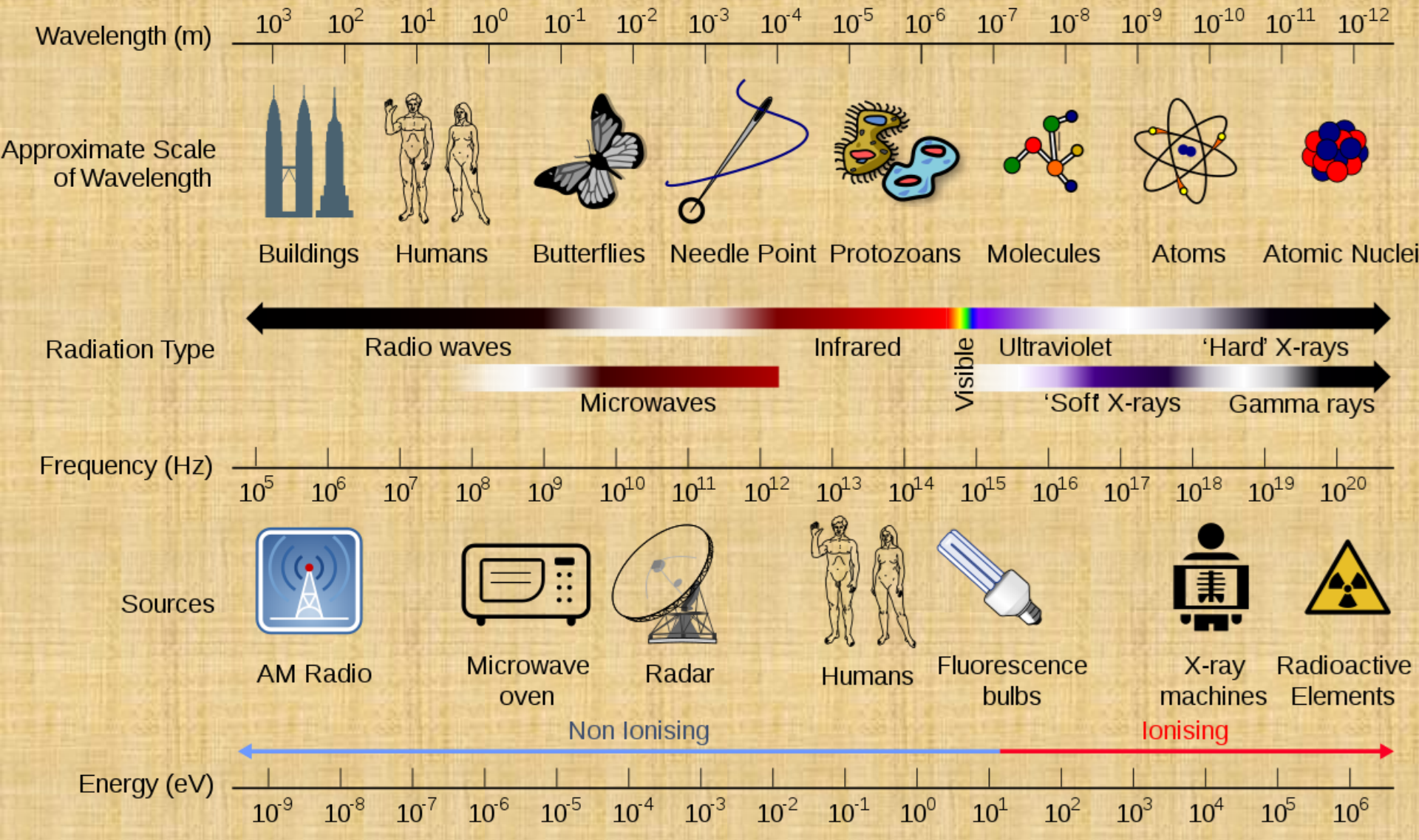
(4)

Light has properties similar to electromagnetic waves

(3)

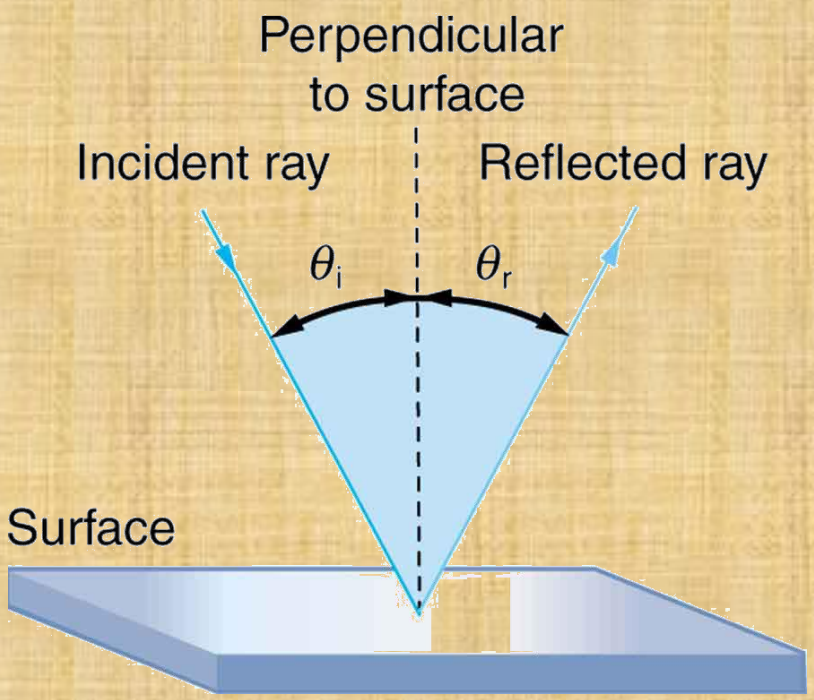
The wavelength of electromagnetic radiation with the range from about $\mathbf{10^{-14}m}$ to about $\mathbf{10^{8}m}$.We use electromagnetic radiation over this whole spectrum in various application of medical physics, **visible light** occupies only a narrow band from about **400-700 nm**.




Wavelength (m)
10^{3} 10^{2} 10^{1} 10^{0} 10^{-1} 10^{-2} 10^{-3} 10^{-4} 10^{-5} 10^{-6} 10^{-7} 10^{-8} 10^{-9} 10^{-10} 10^{-11} 10^{-12}
Approximate Scale of Wavelength
Buildings
Humans
Butterflies
Needle Point
Protozoans
Molecules
Atoms
Atomic Nuclei
Radiation Type
Radio waves
Microwaves
Infrared
Visible
Ultraviolet
'Hard' X-rays
'Soft' X-rays
Gamma rays
Frequency (Hz)
10^{5} 10^{6} 10^{7} 10^{8} 10^{9} 10^{10} 10^{11} 10^{12} 10^{13} 10^{14} 10^{15} 10^{16} 10^{17} 10^{18} 10^{19} 10^{20}
Sources
AM Radio
Microwave oven
Radar
Humans
Fluorescence bulbs
X-ray machines
Radioactive Elements
Non Ionising
Ionising
Energy (eV)
10^{-9} 10^{-8} 10^{-7} 10^{-6} 10^{-5} 10^{-4} 10^{-3} 10^{-2} 10^{-1} 10^{0} 10^{1} 10^{2} 10^{3} 10^{4} 10^{5} 10^{6}

Reflection

Light waves reflect when they strike the surface that separate between two medium, the law of reflection says very simply that when light is reflected the angle of incidence **equals** the angle of reflection.



Light as a Ray

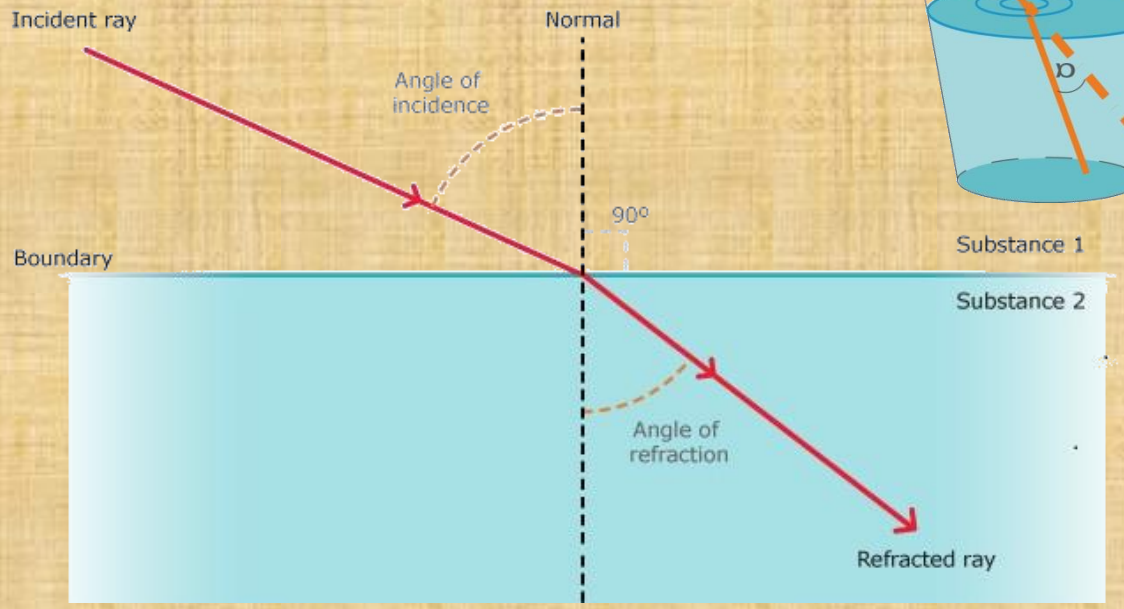
Light comes to an observer's eyes either **directly** or **indirectly** from some source.

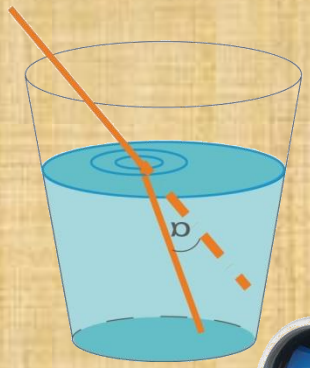
Light Characteristic

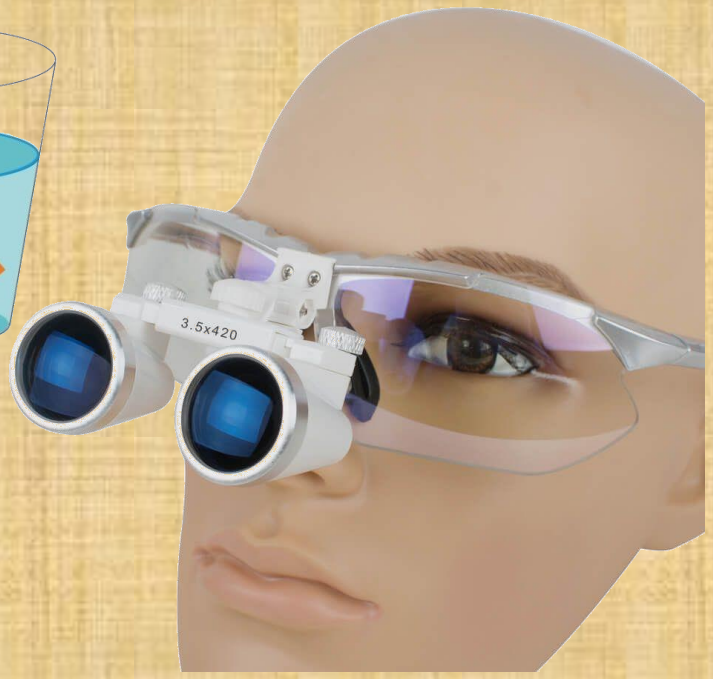
- ✓ Reflection.
- ✓ Refraction.
- ✓ Interference.
- ✓ Diffraction.

Refraction

Light waves usually changes directions when it goes from one medium to another **because** of changes there velocity in the different medium. This is most easily observed for objects partially submerged in water.





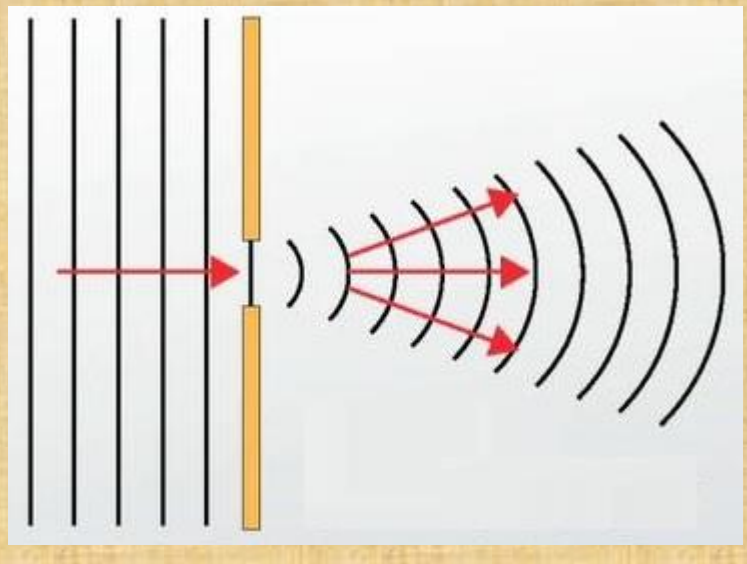


Interference

Light waves interact and interfere with each other in just the same way as do sound waves. The relative phase of the waves determines whether the interference is **constructive**, increasing the intensity, or **destructive**, reducing the intensity.

Diffraction

All light waves undergo diffraction as they pass through a **small opening**.



Light Speed

Light travels in a vacuum at speed equal approximately (**$c=3x10^{8}m.s^{-1}$**). In a transparent medium light speed always less than this in vacuum, and is given by (**V=c/n**).

Where (**n**) is the **index of refraction** of the substance. the value of the **index of refraction** depends on both the **composition** of the substance and the **color** of the light.

Intensity of the Light

Intensity of the light is defined in terms of an energy flux, or power, per unit area and has dimensions of (**Wm^{-2}**).

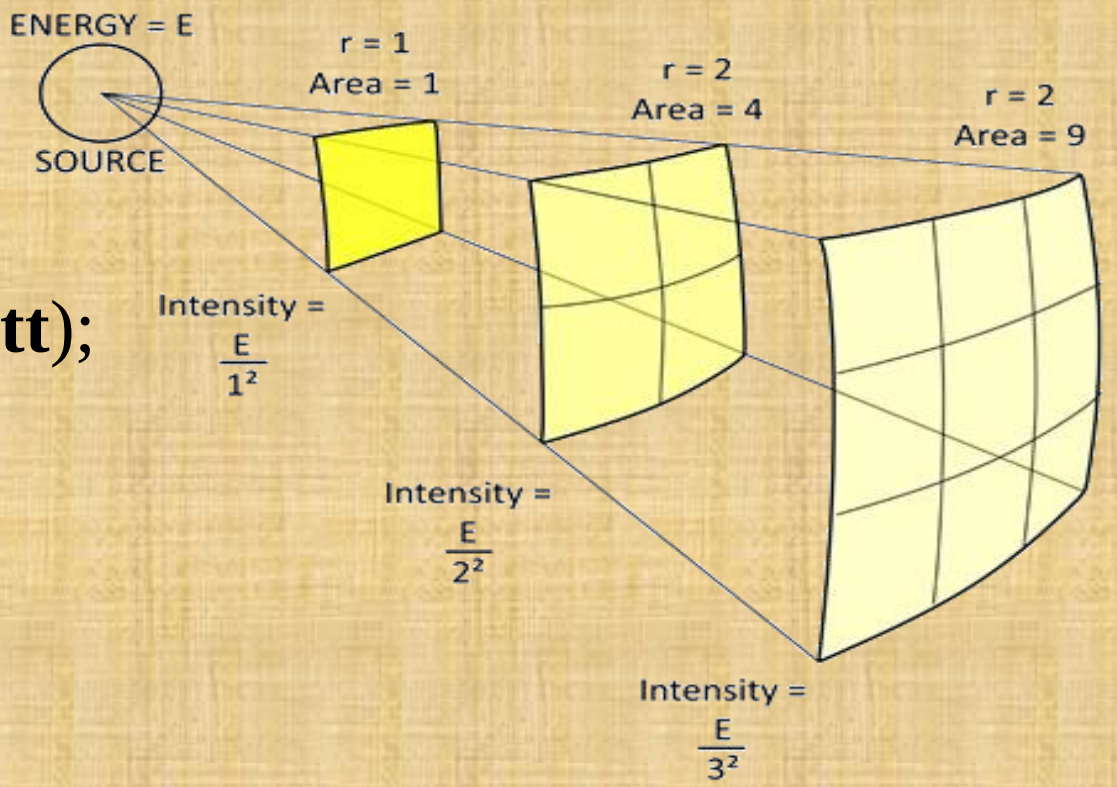
(I=P/A)

Where: -

P = is the power (**Watt**);
A = is the area (**m**).

Relation between light intensity and distance can be given by: -

($I\alpha 1/d^2$)



Light Medical Applications

* In Medicine: -

The light in medicine is beneficial in diagnostic purposes and therapeutic purposes.

A. Diagnostic use of light

There are a number of medical instruments used the visible light in the diagnosis; which are: -

1- Ophthalmoscope.

Used for examining the eyes.

2- Otoscope: Used for examining the ears, nose, and throat.

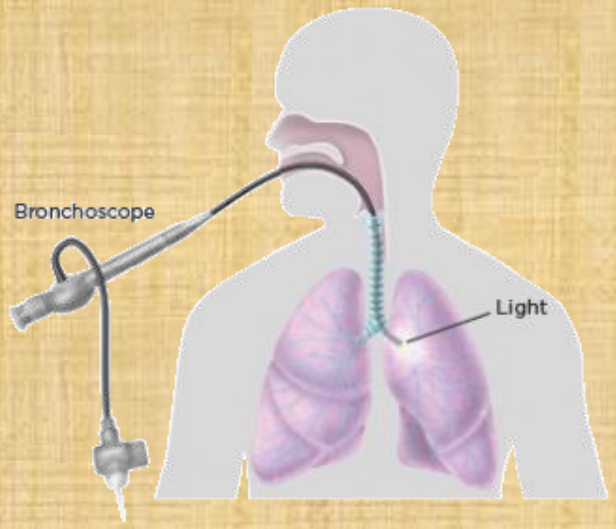
3- Transillumination: the light transmission through of body tissues. It is used clinically in the detection of hydrocephalus (**water-head**) in infants and also used to detect pneumothorax (**collapsed lungs**) in infants.

4- Endoscopes: Used for examining the internal body cavities. Special purposes endoscopes are often given names indicating their purposes, which are: -

* **Cytoscope**: - is used to examine the bladder.

* **Proctoscope**: - is used to examine the rectum.

- **Bronchoscope***:* - is used to examine the air passage into lungs.



B. Therapeutic use of light

Many premature infants have **jaundice**, a condition in which an excess of bilirubin is excreted by the liver into the blood. The most premature infants recover from jaundice if their bodies are exposed to the visible light (**phototherapy**).

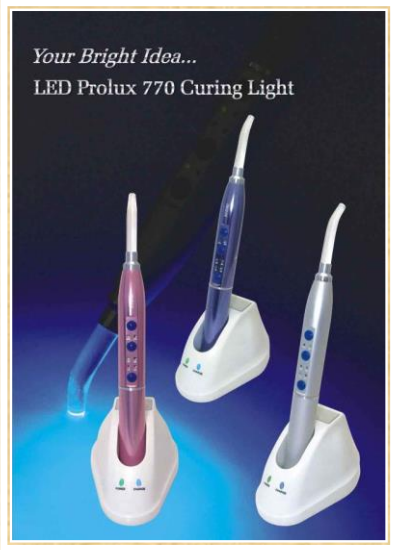
*** In Dentistry: -**

1. Fluorescence is used in medicine is in the detection of **porphyria**, a condition in which the teeth fluoresce red when irradiated with **UV light**.

2- In dental chair.

3- Subgingival calculus detection system: the detector features is a light that reflects off the calculus and is then sensed by an optical fiber and converted into an electrical signal to be analyzed.

4- In light cure:- curing the composite resin.



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