



كلية المستقبل الجامعة
قسم الفيزياء الطبية
المرحلة الثانية

Medical Physics

Optics

Lecture Two

Lecturer: Mohammed Salih

Example of Snell Law:

Q : Light ray incident from air with incident angle (30°) to medium ($n = 1.8$). determine the refractive angle ?

Sol :

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$(0.1) \sin (30) = (1.8) \sin \theta_2$$

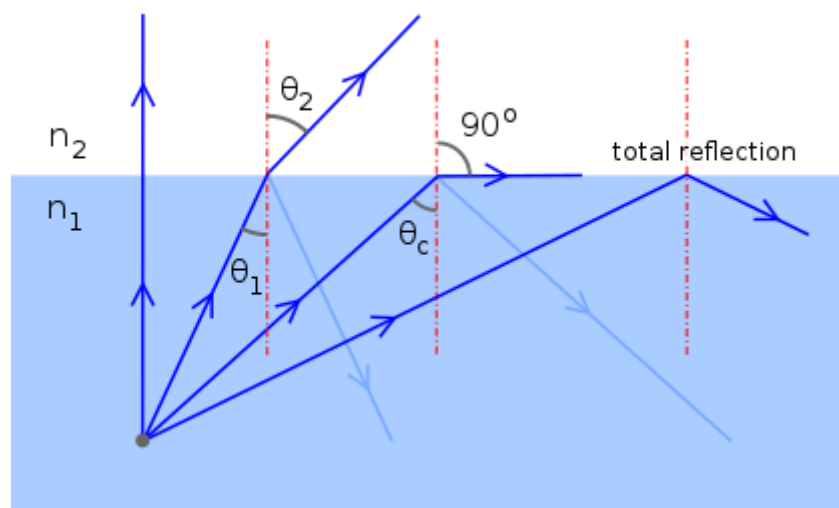
$$\sin \theta_2 = \frac{1 \cdot 0.5}{1.8}$$

$$\therefore \theta_2 = \sin^{-1} \frac{0.5}{1.8}$$

H.W : Light ray incident on surface of lake from below of angle (35°) to air . find the refracted angle of air ?

Total Internal Reflection Phenomenon:

If a ray of light travels from a medium of greater density to a medium of less density, it is refracted away from the normal and closer to the interface. The greater the angle of incidence, the greater the angle of refraction, and the beam gradually approaches the separating surface.



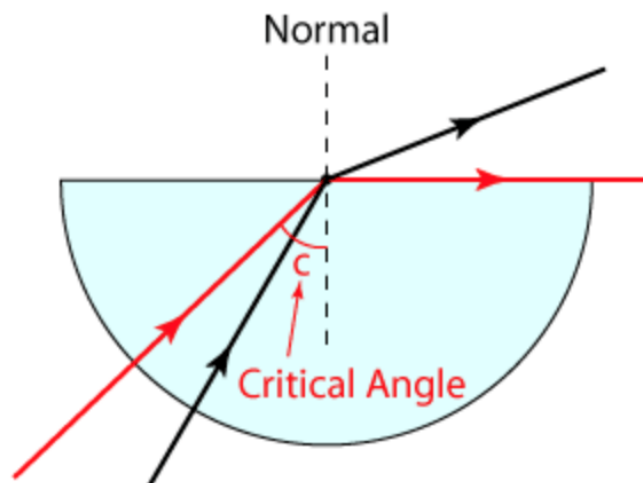
Conditions of Total Internal Reflection :

- 1- If the incident ray is subjected to a difference in the refractive index, and this occurs when it is traversed from one medium to another .
- 2- If the angle of incidence becomes greater than the critical angle and less than 90° .

Critical Angle :

in optics, the greatest angle at which a ray of light, travelling in one transparent medium, can strike the boundary between that medium and a second of lower refractive index without being totally reflected within the first medium. (The refractive index of a transparent substance is the ratio of the speed of light in a vacuum to its speed in that substance.) For any angle of incidence smaller than the critical angle, and for any angle at all if the ray strikes the boundary from the other side, part of the beam will penetrate the boundary, being refracted in the process.

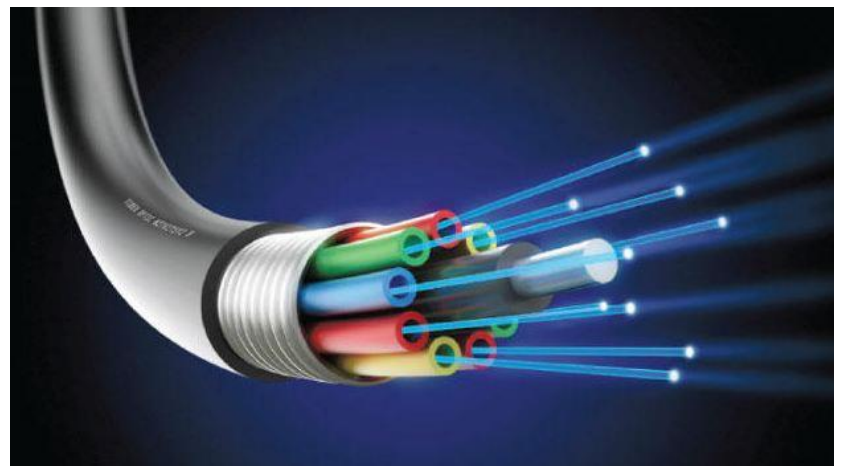
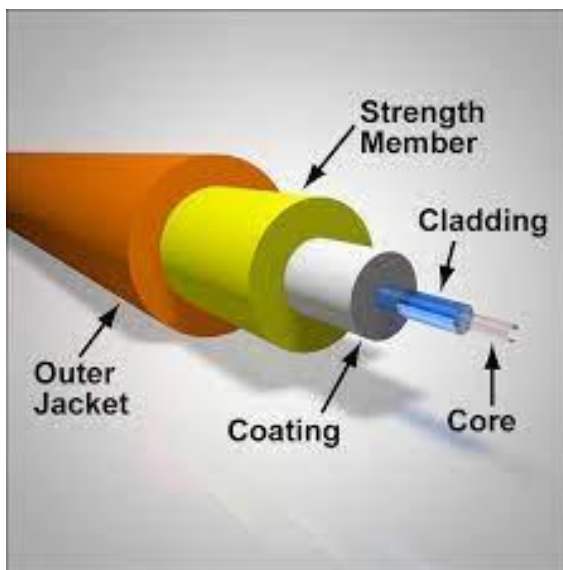
Critical Angel : It is the angle of incidence in the medium of the highest optical density (the largest in the refractive index) corresponding to the angle of refraction in the medium of the least optical density (the lowest in the refractive index) equal to 90° .



Medical Application of Total Internal Reflection :

Optical Fiber :

The most notable application of the phenomenon of perfect reflection is optical fibers. Where a beam of light loaded with data is transmitted through the optical fiber at an angle greater than its critical angle.



Properties of Optical Fiber :

- 1- The optical fiber has a very high flexibility .
- 2- It has optical beams, each containing an amount of optical fibers ranging from 20,000 to 40,000 .
- 3- This large amount of optical fibers allows many light reflections, and from the properties of reflection is that light travels from one end of the beam to the other .

Endoscopy Device :

Endoscopy is the insertion of a long, thin tube directly into the body to observe an internal organ or tissue in detail. It can also be used to carry out other tasks including imaging and minor surgery. Endoscopy can be useful in a wide array of medical situations .

Endoscopes are minimally invasive and can be inserted into the openings of the body such as the mouth . Alternatively, they can be inserted into small incisions, for instance, in the knee or abdomen. Surgery completed through a small incision and assisted with special instruments, such as the endoscope, is called keyhole surgery

Because modern endoscopy has relatively few risks, delivers detailed images, and is quick to carry out, it has proven incredibly useful in many areas of medicine. Today, tens of millions of endoscopies are carried out each year .

We will explain some of the types of endoscopy, why and how they are performed, the general procedure, and any potential risks .



Fast Facts on Endoscopy :

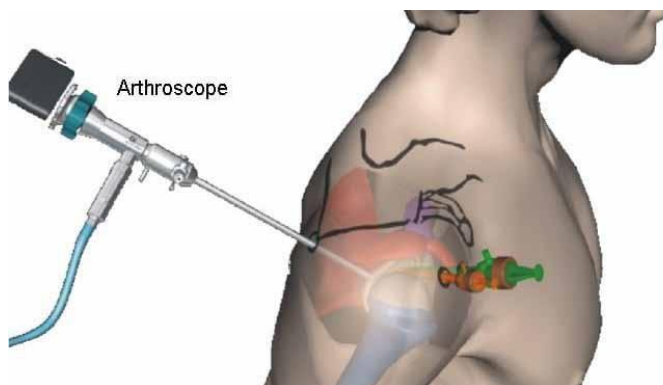
Here are some key points about endoscopy. More detail and supporting information is in lecture :

- 1- Endoscopies are quick and relatively safe procedures
- 2- The first endoscope was designed in 1806
- 3- The main reasons for endoscopy are investigation, confirmation, and treatment.
- 4- Endoscopy can be used to remove tumors or polyps from the digestive tract .

Uses of Endoscopy Device :

Although endoscopy is largely used for the purposes of examining a patient's digestive tract, endoscopes are also used for :

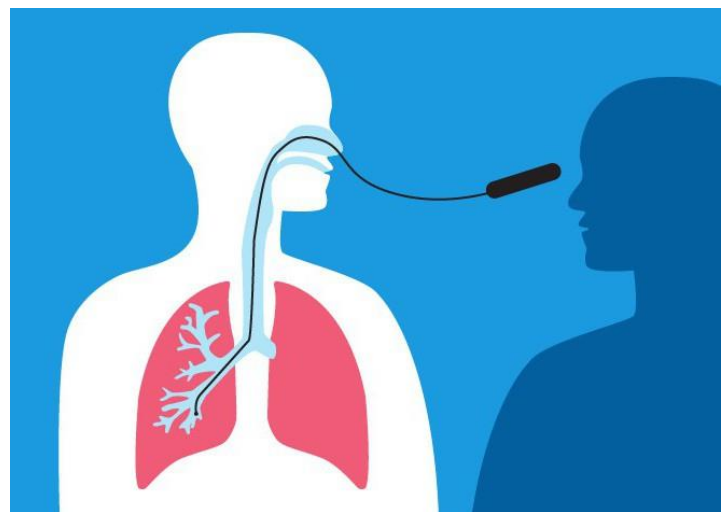
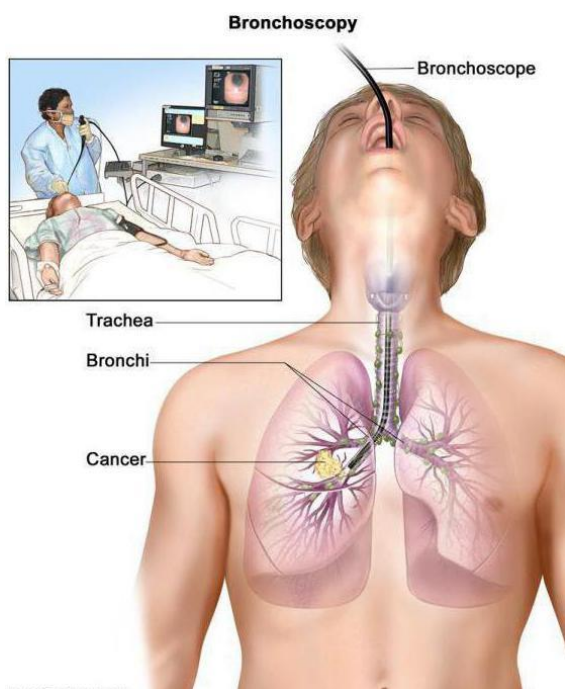
Arthroscopy : This is a medical, surgical procedure that is used to visualize joints, identify the problem and start treatment. For this procedure, the surgeon typically makes a small incision into the skin of the patient and inserts the arthroscopy to visualize the joint. The procedure is particularly useful in the diagnosis of injuries to the joint as well as any diseases that may affect the joints.



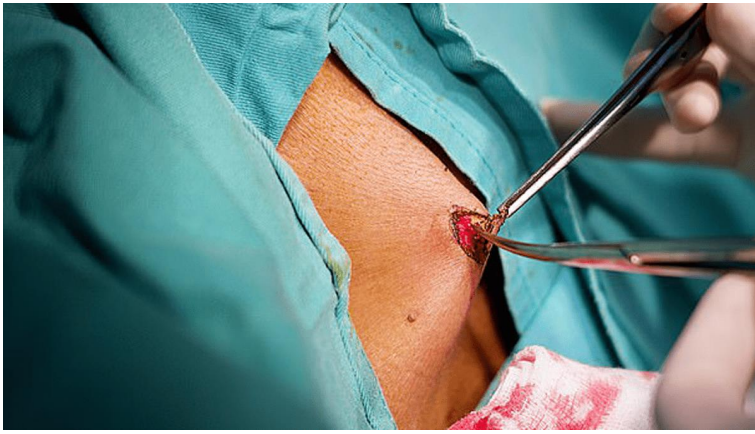
Bronchoscopy : In bronchoscopy, the healthcare professional uses a bronchoscope to visualize the airway. The procedure allows the doctor to closely examine all the parts of the airway including the throat, the larynx as well as the trachea. Bronchoscopy is divided into flexible and rigid bronchoscopy .

Whereas a long, thin and flexible tube is used in flexible bronchoscopy, a straight and hollow metal tube is used in rigid bronchoscopy and requires the use of general anesthesia unlike with flexible bronchoscopy.

Bronchoscopy is used to detect any problems with the airway system and thus treat the problem.



Endoscope Biopsy: Using this procedure, the physician inserts an endoscope through a body opening or a tiny incision to reach the area of interest. By using biopsy forceps, the physician/surgeon can then obtain a tissue sample from the body area for analysis.



Laparoscopy : This is a procedure where the endoscope is inserted into the body through a tiny incision for the visualization of various abdominal organs as well as surgery if need be .

