EXPERIMENT.4

REFRACTION OF LIGHT

Goal: Observing of refraction of light in different medias and calculate the index of refraction.

Theory:

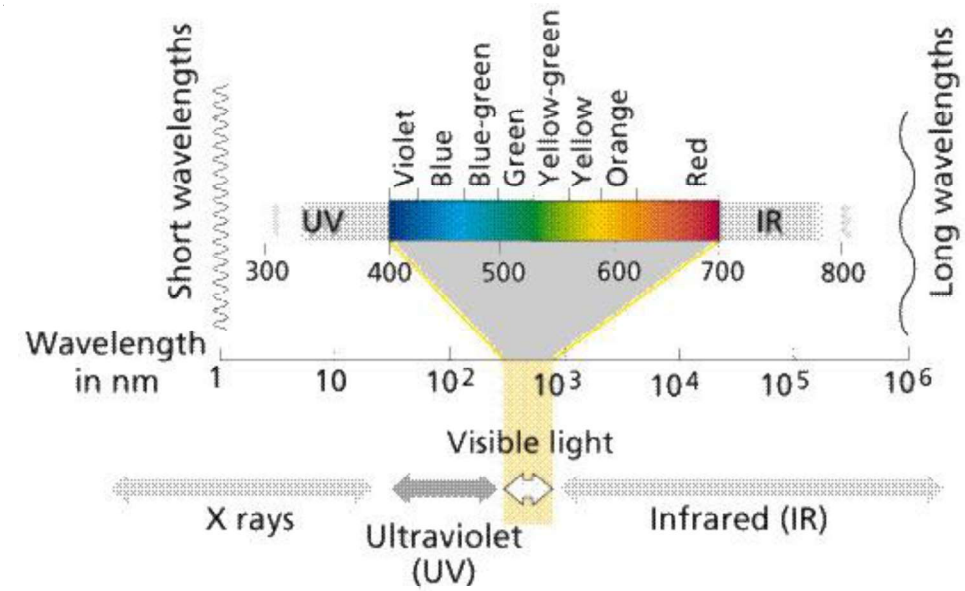


Figure 4.1.The energy spectrum and visible light region

The light beam which is called as “white light” includes different wavelenght of light beams and in the visible spectrum people can observe between 400 and 700 nm wavelenght. This is because the radiation from sun included photons with a large variety of energy values.

Figure 4.2. Beams of sun light

Light travels in straight lines until it encounters another material where it is partially reflected and partially transmitted. The light travels until it meets with a surface and then it is reflected, transmited or absorbed.

After light hits to the surface it has two components : reflected and transmitted. The angle of incidence is equal to the angle of reflection and the angles do not depend on the nature of the material. In refraction the angle of the ray when transmitted through the material changes and depends on the speed of light in the two materials.

The ratio of how we can illuminate a material depends of the photons that are hit the surface. If the surface absorbs the light totally that means we may not see the material because there will be no reflected light.

Sometimes material can only absorbes some waveleghts so that waveleght will not be reflected. Think about the Sun light which shines the "grass". After light beam hits the leafs of the grass only green light is reflected and all others are absorbed.

Some materials are transparent. These ones let the light beam transfer inside and light beam will continue its way without losing its energy (maybe just a little energy lose as heat). Thats how the window pane works.

Nature of Light:

Light velocity in vacuum is **300; 000 km/s or 3.10^8 m/s.** Nothing can move faster than this value (nonrelativistically).

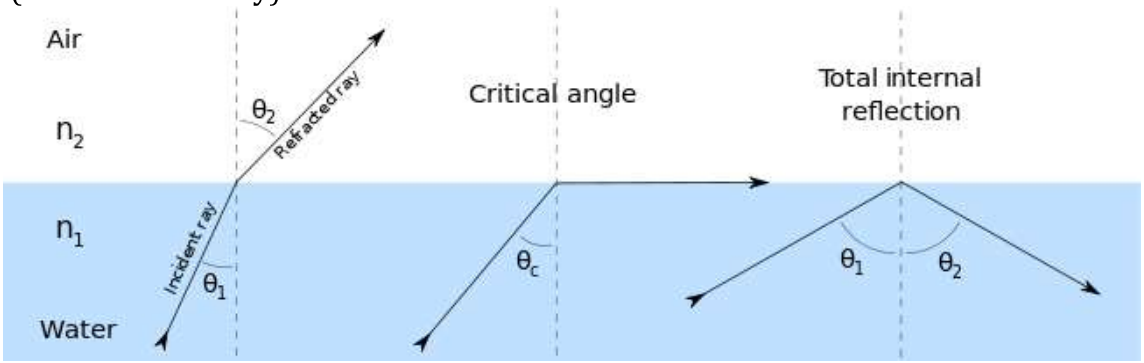


Figure 4.3. incident ,refracted and critical angle

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

θ_1 is the angle between the incoming (incident) light and the Normal and θ_2 is the angle between the outgoing (refracted) light and the Normal. When a light beam comes from a medium with a higher index of refraction and goes to a medium with smaller index of refraction, the beam will be move away from the Normal and the refracted angle will be bigger than incident angle. But the refracted angle can not be bigger than 90^0 . If it is, the light will not transfer to second medium and will move inside the first one . There will be a maximum limit on the incident angle so as to observe refraction which is called critical angle θ_c and above this value the light will not transfer to second medium . That is called total internal reflection.

Experimental Setup:

Apparatus:

1.) Light source
2.) Materials with different index of refraction
3.) graded angle sheet (attached on the lab. sheet)
4.) Ruler, protractor
5.) Calculator

EXPERIMENTAL SETUP AND MEASUREMENTS:

1. Place the material on the sheet and use point source and focus it on the origin.

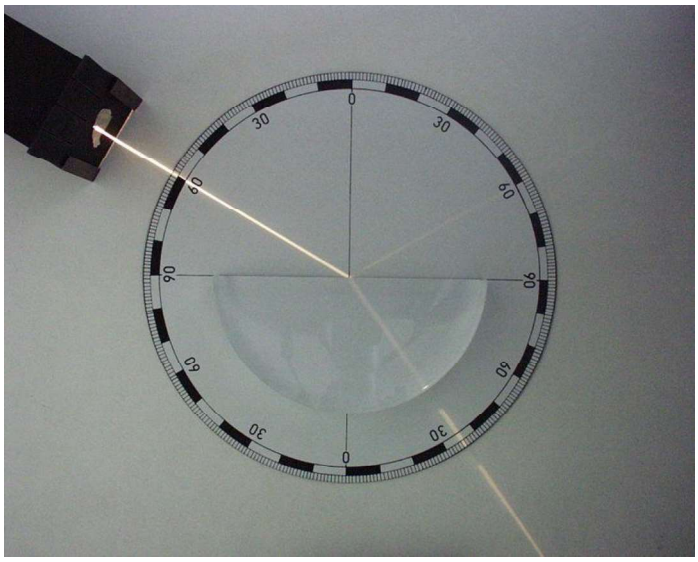


Figure.4.1

2. Use the incident angle values which are given in the table and adjust your point source to these angles. Then one by one measure outgoing angle and fill the table.

3. Draw a graph between the incoming and outgoing angles. What it tells you ?

4. Draw a graph between the sin values of incoming and outgoing angles. What it tells you

5. Incident index of refraction belongs to air. Use the formulation and calculate the index of refraction of unknown material.

6. Do the error calculation by comparing theoretical and experimental value of index of refractions.

7. Calculate the maximum relative error in any measurements of refractive index.

8. Find the average standard deviation by using calculated n values.

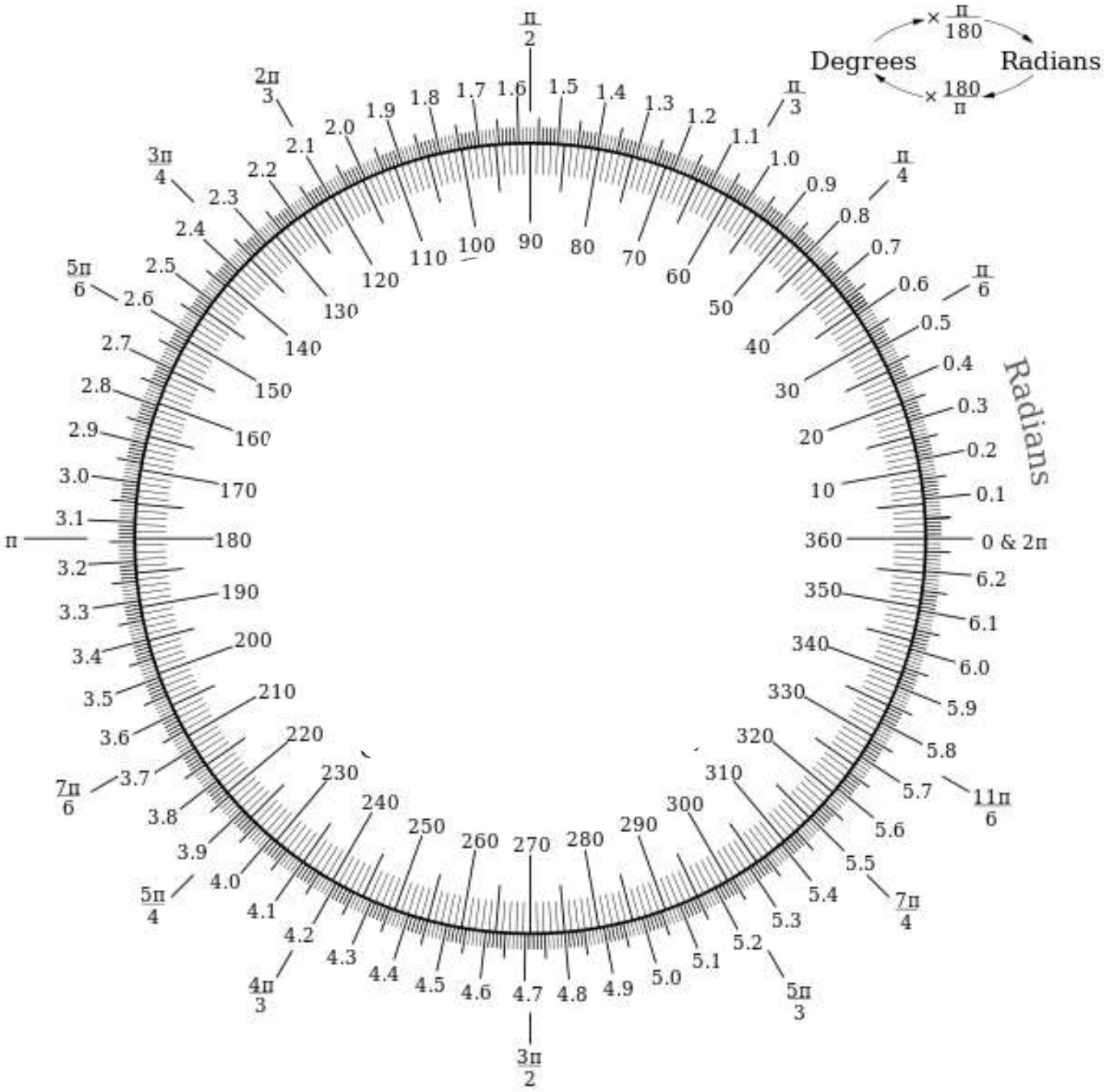
9. Write error causes in order.

10. Write the results and comments about experiment via obtained data.

11.) Interpret your conclusions.

	Angle (θ_0)	$\sin(\theta_0)$	$\sin(\theta_i)$	n_0	n_i
1	10				
2	20				
3	30				
4	40				
5	50				
6	60				
7	70				
8	80				
9	90				

EXPERIMENT.4 REFRACTION OF LIGHT


Degrees
Radians
× π/180
× 180/π
Radians
π/2
2π/3
π/3
3π/4
π/4
5π/6
π/6
π
7π/6
11π/6
5π/4
7π/4
4π/3
5π/3
3π/2
0 & 2π