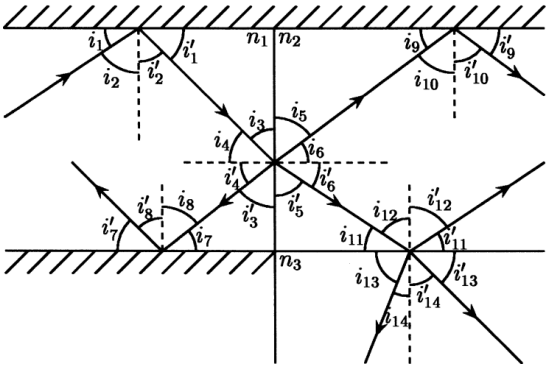
Faculty of matter Sciences and Computer Science
Department of Physics – L2_Physics
Exercise Series of Geometrical and Physical Optics, 2025-2026
Exercise Series Number 1: Gemetrical Optics Part 1

Exercise 01:

1. Redo the diagram opposite, leaving only the light rays that actually exist.
2. Give all the possible angular relations, specifying for each one whether it is of geometric or optical origin.



Exercise 02:

A ray of light in the air falls on the surface of a liquid; it makes an angle α = 56◦ with the horizontal plane. The deviation between the incident ray and the refracted ray is θ = 13.5◦. What is the index $\boldsymbol{n}$ of the liquid?

Exercise 03:

The table below gives the wavelengths, in a vacuum, of two monochromatic radiations and the corresponding indices for two different types of glass.

Color	$\lambda_0(nm)$	n(crown)	n (flint)
Red	656.3	1.504	1.612
Blue	486.1	1.521	1.671

1. Calculate the frequencies of these light waves. Do they depend on the index of the medium? We will take $C_0 = 2,998.108\ m.s^{-1}$.

2. Calculate the velocities and wavelengths of the red radiation in the two glasses.

3.

a) A ray of white light arrives on an air-glass plane diopter, under the incidence $i = 60°$. The air index is taken to be equal to 1, 000. Recall Descartes' laws relating to the refraction of light.

b) Calculate the angle that the blue ray makes with the red ray for a crown glass, then for a flint glass.

c) What is the most refracted glass?

Exercise 04: ***Brewster incidence angle***

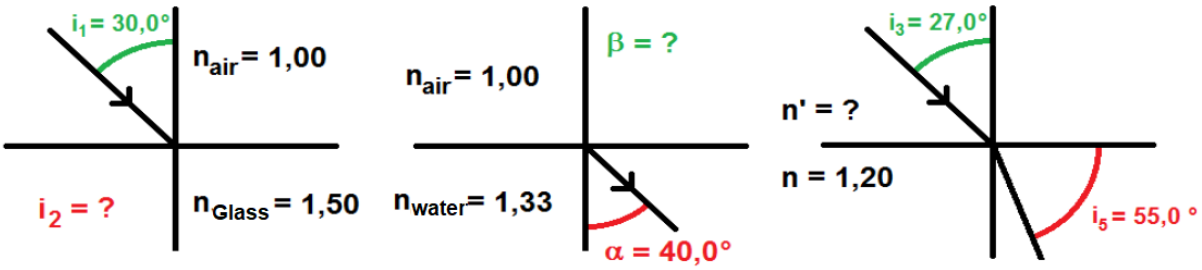
A plane diopter separates the air from a medium of index n. A monochromatic light beam arrives on this diopter with an angle of incidence i. Part of the beam is reflected and the other part is refracted.

1. For a grazing incidence ($i = 90°$) (when the ray grazes the surface, i.e. when it is tangent to the surface), the angle of refraction reaches the limit value $r_{lim} = 43°$. Calculate the refractive index n of this medium. The index of the air being equal to 1.

2. For what value of the angle of incidence is the refracted ray perpendicular to the reflected ray (called Brewster incidence angle)?

Exercise 05:

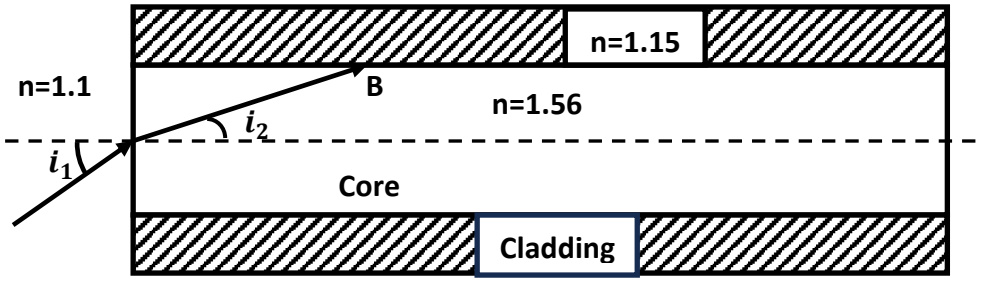
We consider the following 3 cases:



- In the 1st case, calculate the angle of refraction i_2 ;
- In the 2nd case, calculate the angle of incidence β
- In the latter case, calculate the refractive index n'.

Exercice 06 :

We consider an optical fiber composed of a core surrounded by a sheath according to the following cross-sectional diagram:



1. Can there be total reflection in B ?
2. What is then the value of i_{3limit}, the angle of incidence by corresponding to this total reflection B?
3. Deduce the angle $\boldsymbol{i_1}$ corresponding.

Exercice 07 :

1- Express the optical path L_{AB} for a ray of light going from point A to point B in air that is assimilated to a vacuum.

2- A thin glass slide of thickness $\boldsymbol{e}$ and index $\boldsymbol{n}$ is inserted into the path of light between points **A** and **B**. Express the new optical path.

3- What distance in the air would have to be added to obtain a path equal to that covered in the presence of the glass slide?

4- Realize the numerical application: $AB = 2cm;\ \ e = 1mm; n = 1.5.$