Exercise 1**----------

In air, a monochromatic light ray strikes a prism with an apex angle of **A = 30°** and a refractive index of **n = 1.25.** Determine the angles of incidence ***i*** and emergence ***i'*** in the following cases:

1. At normal incidence.
2. At minimum deviation.
3. At grazing emergence.
4. At grazing incidence.
5. At normal emergence.
6. Plot the total deviation D_T as a function of the angle of incidence ***i***.

Exercise 2**----------

In air and at an incidence of **i**, a light ray strikes the face **AB** of a prism with an apex angle **A**, section **ABC**, and refractive index **n**.

1. Recall the emergence conditions of the incident ray as a function of **A** and i.

2. Applications : A = 120°, n = 1.5 ; A = 60°, n = 1.5

Exercise 3**----------

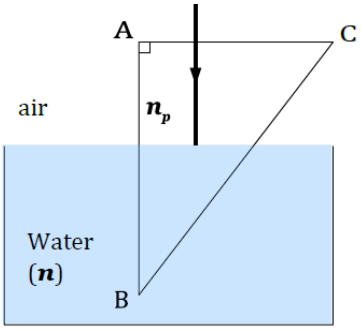
The prism of a spectroscope has an apex angle of **60°.** Its refractive index, for the yellow light of sodium, is **1.751**

1. In this prism, immersed in air, determine the minimum deviation of the yellow light of sodium and the corresponding angle of incidence $\mathbf{i_m}$.

2. Light from a hydrogen tube, formed of red and blue radiation, for which the refractive indices of the prism are **1.742** and **1.769**, respectively, is incident on the prism at the previous incidence $\mathbf{i_m}$. Determine the angle formed by the red and blue rays at the exit of the prism.

Exercise 4 ----------

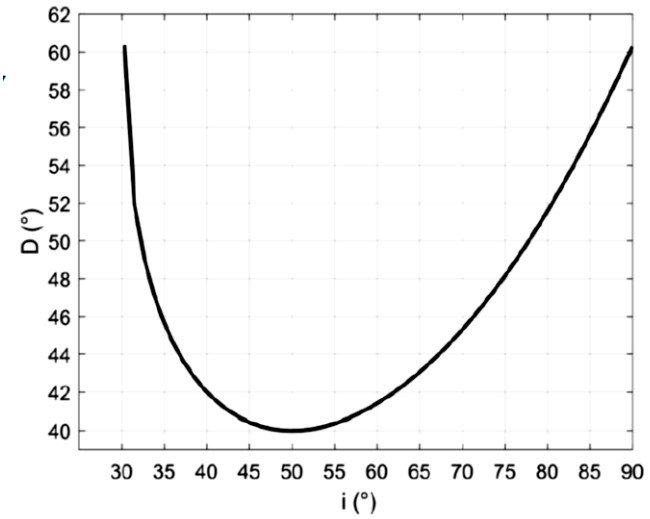
A beam of light enters at normal incidence a glass prism of refractive index $\mathbf{n_p}$, part of which is immersed in water. Show that there is a limiting value of angle **C** beyond which the ray does not emerge through face **BC**.



Exercise 5 ----------

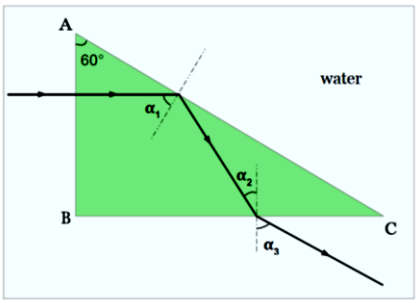
The curve in the figure opposite represents the deviation **D** of a light ray by a prism with an apex angle **A** and refractive index n, immersed in air, as a function of the angle of incidence **i**.

1. Determine the value of **A** from the graph. Deduce the index **n** of the prism (give the value to three decimal places).
2. Find the angle of emergence of the light ray from the graph when the angle of incidence is **35°**. Calculate the angle of emergence using the refraction formulas. Compare with the value found graphically.
3. Deduce the angle of incidence $\mathbf{i_0}$ from the graph, for which the emergence is grazing.



Exercise 6 ----------

A prism, with index **n = 1.60**, is completely immersed in water. A laser beam is sent perpendicular to face **AB**. It emerges through face **BC**, after being reflected by face **AC**. Calculate the angles $\boldsymbol{\alpha_1}$, $\boldsymbol{\alpha_2}$ and $\boldsymbol{\alpha_3}$.



Exercise 7----------

A glass prism with a refractive index $\mathbf{n} = \sqrt{2}$ and a cross-section of an equilateral triangle **ABC** is immersed in air. A monochromatic light ray strikes it at point **I** on face **AB** and passes through it at the minimum deviation.

1. Determine the values of the angles of incidence, refraction, emergence, and minimum deviation. Draw a diagram.

2. Without touching the incident ray, rotate the prism around an axis passing through **I** and parallel to its edge through an angle **β**. What happens to the emergent ray for $\beta = +45°$ and $\beta = -45°$?
   Draw a diagram for both and calculate the total deviation of the incident ray.

Exercise 8----------

An optical system consists of two Crown prisms (glass) with cross sections, represented by right triangles (**ABC**) and (**DCE**) (see figure). The apex angles **A** and **D** are **30°**. This optical system is illuminated perpendicular to face **AB** by a monochromatic light beam. The refractive index of the prisms is $\mathbf{n_V = 1.515}$ and the refractive index of air is $\mathbf{n_A \approx 1}$.

1. Draw qualitatively (without doing any calculations) the path of the light beam crossing this optical system.

2. Calculate the angle of emergence of the light beam through face **AC** of prism **ABC**.

3. Calculate the angle of incidence of the beam on face **DC** (we can consider space **ACD** as a prism with an apex angle of **60°** and index $\mathbf{n_A}$). Deduce the angle of refraction on face **DC** as well as the angle of emergence through face **DE**.

4. Calculate the deflection undergone by the light beam upon exiting prism **ABC**. What is the total deflection of the emerging beam through face **DE**?