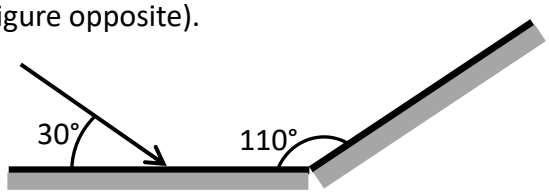
Faculty of matter Sciences and Computer Science
Department of Physics – L2_Physics
Exercise Series of Geometrical and Physical Optics, 2025-2026
Exercise Series Number 2: Plane and spherical mirrors

Exercise 01:

Two plane mirrors, M1 and M2, touch each other to form an angle of 110°. Let be an incident ray making an angle of 30° with the mirror M1 (see figure opposite).

1- Detail the path of the ray and determine in which orientation (angle) the light leaves M2?

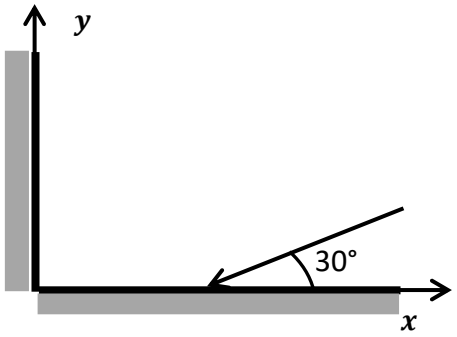
2- Calculate the total deviation of the incident ray?



Exercise 02:

We consider two plane mirrors placed perpendicular to each other. An incident ray, making 30° with the horizontal axis, is reflected by the bottom mirror (see figure opposite).x

Find the angle that the emerging ray makes with the vertical axis, after reflection on the second mirror. y

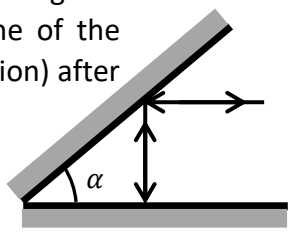


Exercise 03 :

An optical system consists of two plane mirrors forming an angle α between them, such that a light ray incident parallel to one of the mirrors is reflected back along the same path (opposite direction) after undergoing three reflections.

1. What is the angle of incidence on the 1st mirror?

2. Deduce the value of the angle α.



Exercise 04 :

To observe his own reflection, a man stands in front of a rectangular plane mirror mounted on a vertical wall. His eye is at a height of $l = 1.70\ m$ above the ground. The bottom edge of the mirror is positioned at a height h above the ground.

1. Determine the maximum height h for man to see his feet.
2. How does this height vary according to the distance d of the eye from the mirror?
3. What is the minimum height of the mirror required for the man to see his entire body, from head ($l' = 1.80\ m$) to feet?

Exercise 05:

An object AB is placed in front of a concave spherical mirror with center of curvature C, vertex S, and a radius of curvature of $50\ cm$. Point A is located $1\ m$ from the vertex S.

1. Determine the position of A'.
2. Calculate the linear magnification and specify the nature of the image.

Exercise 06:

We place a small real object AB at $250\ cm$ in front of a concave mirror with a radius of $125\ cm$.

1. Find the $A'B'$ position of its image as well as the magnification γ.

2. What is the position of the image and the magnification in the case where the object AB was virtual and placed at $100\ cm$?

Exercise 07:

A concave spherical mirror has a radius of curvature of $8\ cm$. A real object is positioned at a distance $p = 12\ cm$ from the mirror, with its tip located $y_0 = 4\ mm$ above the optical axis.

1. Draw the principal rays corresponding to the object.
2. Determine the position of the image using the mirror equations.

Exercise 08:

A convex spherical mirror has a radius of curvature of $8\ cm$. A real object is placed at a distance of $p = 4\ cm$ from the mirror, with its tip located $y_0 = 4\ mm$ above the optical axis.

1. Draw the principal rays corresponding to the object.
2. Determine the position and characteristics of the image using the mirror equations.

Exercise 09:

A convex mirror placed in the air gives a virtual image of a real object placed 27 cm from its top, this virtual image is reduced by a factor of 3.

1. Calculate the power (vergence) V of the mirror.

2. Determine the nature and radius of curvature of the mirror.

Exercise 10:

We consider a spherical mirror with a radius of curvature R ($R = \overline{SC}$) and vertex S.

1. Where should an object AB be placed so that $\overline{SA} = \overline{SA'}$?
2. Calculate the transverse magnification γ of the mirror.
3. Is an object placed at this point coincident with its image?

Exercise 11:

Consider a spherical mirror with a radius of curvature $R = \overline{SC} = 60\ cm$. A real, vertical object (AB) with a height of $h = \overline{AB} = 10cm$, is placed along the optical axis at a distance of $30\ cm$ from the mirror's vertex.

1- Without performing any calculations, determine the nature of this spherical mirror. Justify your answer.

2- Write the conjugation relation, taking the vertex **S** of the spherical mirror as the origin, for the pair of conjugate points **(A, A').**

3- Determine the position of the image $(A'B')$ with respect to the mirror vertex S.

1. What is the nature of the image $(A'B')$? Justify your answer

4- What is the direction and height $h' = \overline{A'B'}$ of the image (A'B')?

5- Show that a convex spherical mirror can never give a real image of a real object.

6- On a figure, find the image $(A'B')$ geometrically.

Exercise 12 :

We consider a spherical mirror with vertex S, center C and radius of curvature $\overline{SC} = 9cm$. the mirror is used in Gaussian conditions.

1. Is this mirror convergent or divergent? Justify.
2. Write the conjugation relation of the position of the mirror with origin at the vertex S.
3. Determine the positions of the focus F and image F' de ce miroir en cm.
4. What should be the position in relation to S, on the optical axis, of an object (AB) so that its image $\overline{A'B'}$ is 3 times larger than the object and in the same direction
5. Let be a vertical and virtual object (AB) of dimension $\overline{AB} = 2cm$ and at the distance of $3cm$ from S.
6. Find your image $\overline{A'B'}$ by geometric construction (1/2 scale) then calculate the transverse magnification and the size of the image $\overline{A'B'}$

Exercice 13 :

A concave spherical mirror with center C, radius $R = 6cm$ and vertex S. A real object (AB), size $1cm$, is located at a distance of 9cm from the vertex S.

1. Specify the position and nature of the mirror's foci.
2. Construct, geometrically, the image $(A'B')$ of the object (AB) on a real scale through the mirror. From this, deduce its nature, position and size.
3. Find these results by applying the conjugation formulas relating to the spherical mirror. We will consider the case of approximate stigmatism.
4. Where should we place an object (AB) to obtain an image (A'B') straight and twice as large as (AB)?
5. Give the position of this image in relation to the vertex S and deduce its nature.