

Sequence 5: image formed by a converging lens



Fiches de synthèse mobilisées (collection en français) :

- Fiche n°4 : lentilles convergentes et modèle optique de l’œil
- Fiche n°5 : la relation de conjugaison des lentilles



Sommaire des activités ETLV :

ACTIVITY 1: determining the focal length of a converging lens

ACTIVITY 2: comparing focal length measurements

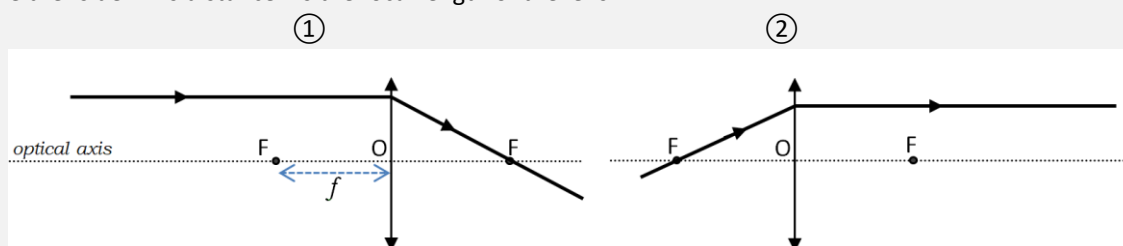
ACTIVITY 1: determining the focal length of a converging lens

An emmetropic eye (without any visual defect) sees a far optical object without any effort, it does not accommodate. The observation without accommodation through an optical system can be done only if the image is formed at infinity. Afocal systems, such as optical telescopes, allow this effortless observation.

A method called “**autocollimation**” (studied further in sequence 5, activity 2) uses one simple mirror in order to find focal length of a converging lens.

DOCUMENT 1: focal points of a converging lens

A thin converging lens has two focal points, located on the optical axis, a distance f from the center of the lens on either side. This distance f is the focal length of the lens.

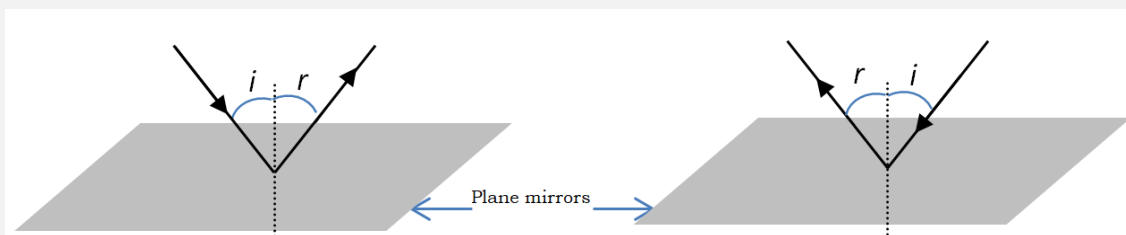


① A ray entering a converging lens parallel to the optical axis passes through the focal point on the other side of the lens.

② A ray that passes through the focal point exits the converging lens parallel to the optical axis.

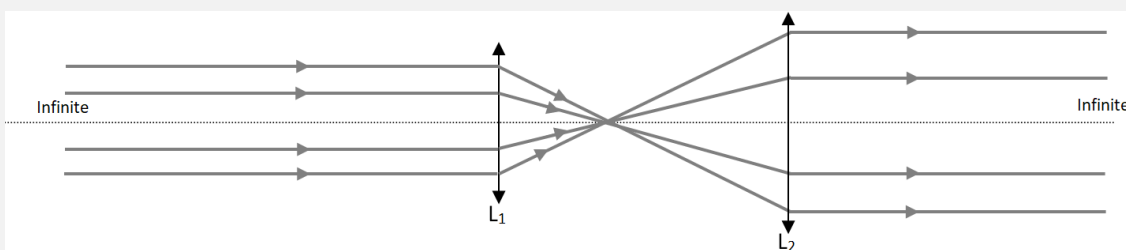
DOCUMENT 2: plane mirrors

A plane mirror is a mirror with a flat reflective surface. For light rays striking a plane mirror, the angle of reflection r equals the angle of incidence i .



DOCUMENT 3: the refracting telescope

The refracting telescope is an afocal system made of two converging lenses (L_1 and L_2); it allows far object observation without any accommodation. The light rays coming from infinity are represented by a parallel light beam:



DOCUMENT 4: available laboratory equipment

- An optical bench with a source light and an optical object (a p letter);
- A plane mirror;
- A 5-diopter converging lens.

■ **Acquiring vocabulary:**

English	French
	Autocollimation
Afocal system	
Light ray	
Light beam	
Plane mirror	
Optical bench	
	Infini
	Lentille convergente
Focal length	
Optical axis	
Retina	

■ Questions

1. UNDERSTANDING DOCUMENTS

- The focal points on document 3 are not represented. Draw them on each lens L_1 and L_2 .
- Draw a parallel light beam entering lens L_2 on document 3.

2. ANALYZING

- Imagine a light source S , placed on the focal point of a converging lens (on the left-hand side of the lens). The light beam that exits the lens, encounters a plane mirror placed perpendicular to the optical axis. Map all the light rays, from the light source to the mirror and after their reflections.
- What can we say about the positions of the light source and its image?

3. EXPERIMENTING With the available laboratory equipment on your table, carry out the previous experiment.

4. COMMUNICATING One of your mates is missing today. You have to explain to him/her the autocollimation method in order to identify the focal point of a converging lens.

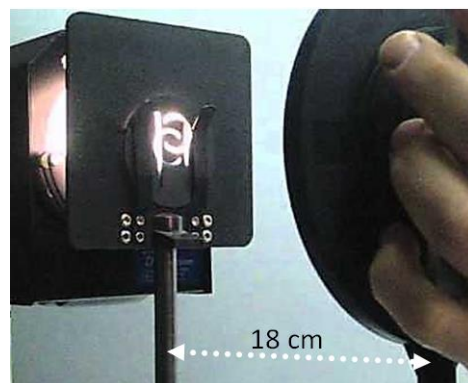
■ Application

We can observe on the following picture an operator positioning a plane mirror in front of a converging lens. The light source is a P object.

⇒ **What is the focal length of this converging lens?**

The optical power is defined as the inverse of the focal length. It is expressed in diopters (δ).

⇒ **What is the optical power of this converging lens?**



Connaissances et capacités à maîtriser

Ce qu'il faut savoir :

Le vocabulaire à savoir définir et utiliser à bon escient :

- Emmetropic
- To accommodate
- Autocollimation
- A light beam
- Infinite
- A converging lens
- The focal points
- The optical axis
- An afocal system

Les grandeurs physiques à savoir définir et exprimer avec la bonne unité :

- The focal length f'
- The optical power

Les relations à connaître et à savoir exploiter :

$$\text{optical power (diopter)} = \frac{1}{\text{focal length (meter)}}$$

Ce qu'il faut savoir faire :

Compétences	Capacités à maîtriser	Où dans cette séquence ?
RCO	Focal length	Document 1
	Optical power	Application
APP	Utiliser du vocabulaire spécifique	Question 4
	Lire et comprendre des documents scientifiques	Question 1
ANA	Mettre en lien des documents pour émettre des hypothèses en réponse à une question scientifique	Question 2
REA	Mettre en œuvre un protocole	Question 3
COM	S'exprimer à l'oral en utilisant le vocabulaire adapté	Question 4