



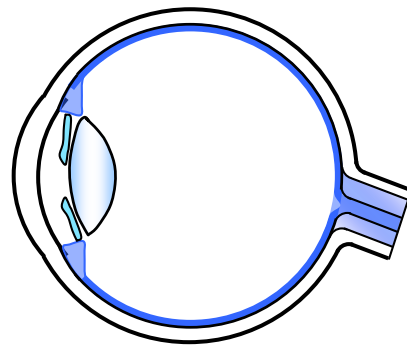
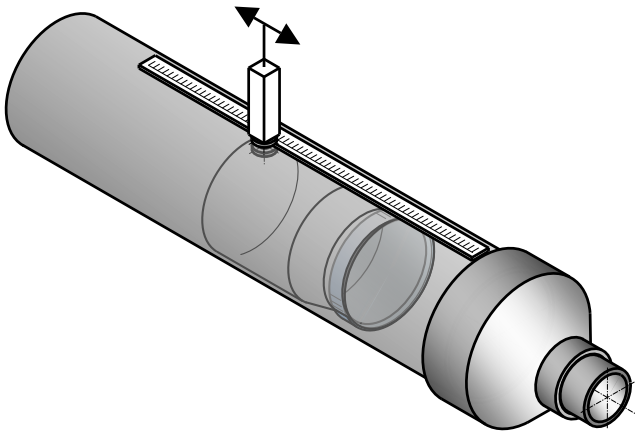
**centre de
développement
pédagogique**
*pour la formation générale
en science et technologie*

Name: _____

Group: _____

OPTICS AND VISION

Learning activities



Working document

October 2014

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Background

The human eye is an impressive organ. You have no doubt studied its anatomy theoretically and maybe even have had the chance to dissect an eye yourself. Surely then, you appreciate the delicacy of its structures and its fragility. The basic principles of its function are simple enough, however. The iris adjusts automatically to the amount of light it receives. The crystalline lens adjusts based on the distance of the object to be observed.



Throughout this learning situation, you will have the opportunity to become familiar with the basic functioning principles of the eye. These principles are grouped under the name of "Geometrical optics". Among others, we will touch upon: light, refraction and divergent and convergent lenses.

The study of these principles will be made simpler using the model of an eye made from a simple plastic plumbing pipe. Even if at first glance, the model seems boring, you will most certainly have fun using it. The similarities this model shares with the human eye will show what would otherwise remain hidden. Looking inside the model is like diving into the eye and observing the image projected on the retina. You need to keep in mind, however, that this model is a simplified version of the human eye. It cannot simulate the finesse of all its capabilities.



Finally, the human eye does not always work perfectly. Sometimes, it has anomalies that need correction. Illness or accidents may also affect its function. Many specialists concentrate their efforts so that our vision is perfect. Maybe a career in this field would interest you? At the very least it is likely that someday you will cross paths with one of these professionals. Here are some avenues concerning these professions and the schooling associated to them:

- **Optician** — DCS in "Techniques d'orthèses visuelles" (Eye wear techniques) (3 years of college studies)
 - ✓ Eye wear expert
 - ✓ Works based on a prescription from an optometrist or ophthalmologist
 - ✓ Replaces, adjusts, sells glasses or contact lenses
- **Optometrist** — Doctor of Optometry degree (4 years of university studies)
 - ✓ Examines the eyes (exam, diagnosis, prevention)
 - ✓ Issues prescriptions
 - ✓ Recommends treatment (other than medication or surgery)
 - ✓ Directs patients toward physicians (ophthalmologists, surgeons, etc.)
 - ✓ May adjust and sell glasses or contact lenses
- **Ophthalmologist** — Doctor of medicine (≈10 years of university studies)
 - ✓ Medical specialist
 - ✓ Treats ocular illnesses
 - ✓ Corrects vision problems
 - ✓ Performs ophthalmologic surgery
 - ✓ Issues prescriptions

Let's warm up a bit!

This section will define what you already know, before going on to new concepts. This new knowledge will help improve your understanding of human vision. Building this network of concepts will allow you to organise your knowledge visually. So take a few minutes to make this card related to the study of vision.

Network of concepts

eye

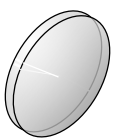
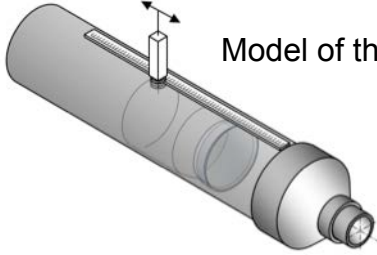

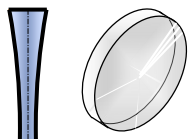
Scientific Investigation Process



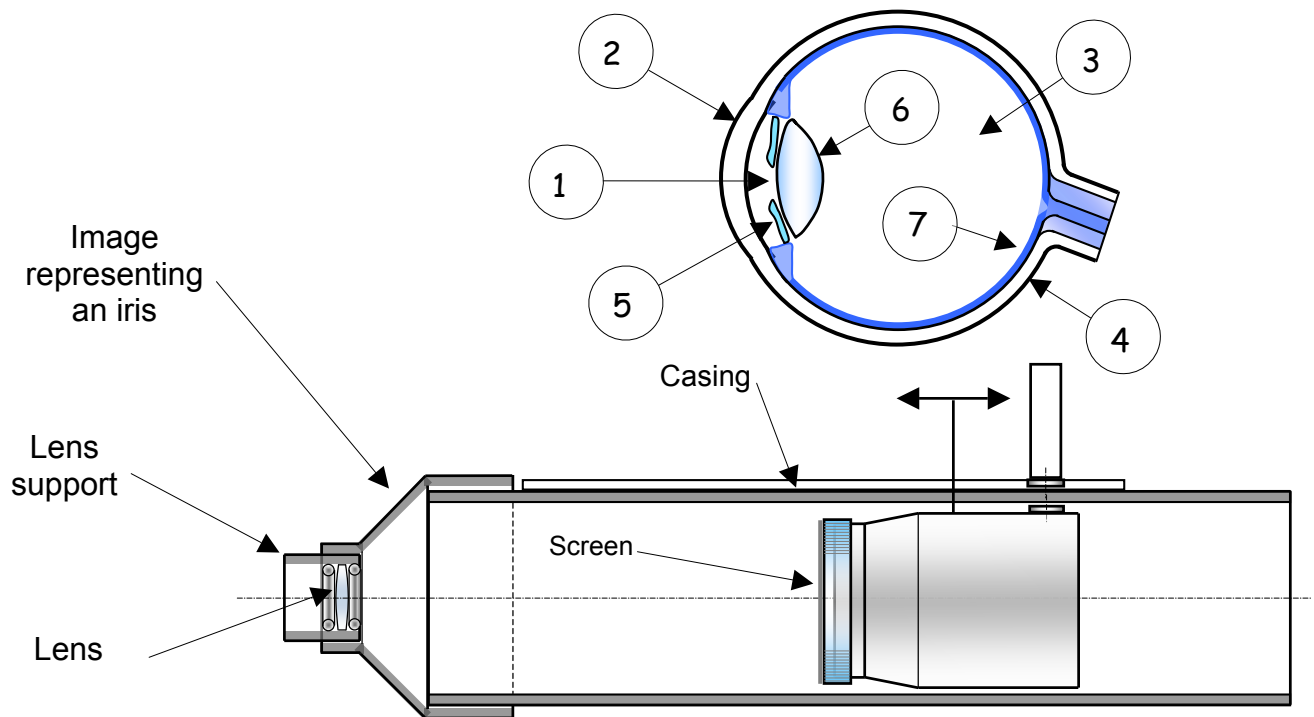
We now propose that you undertake two scientific investigation processes. Two notebooks will accompany you and help you bring these processes to term. Here are the subjects broached:

- Scientific investigation about the convergence and divergence of light rays
- Scientific investigation about the formation of images using the model of the eye

Directed lab (addition of glasses to the model of the eye)

Questions	
How does the formed image move if we add a convergent corrective lens to the model?	How does the formed image move if we add a divergent corrective lens to the model?
Hypotheses	
I believe that the addition of a convergent lens _____ the image of the lens because this lens makes the rays converge closer to the lenses.	I believe that the addition of a divergent lens _____ the image of the lens because this lens makes the rays converge further from the lenses.
Equipment at your disposal	
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;">  <p>Convergent corrective lens</p> </div> <div style="text-align: center;">  <p>Model of the eye</p> </div> <div style="text-align: center;">  <p>Distant objects</p> </div> <div style="text-align: center;">  <p>Divergent corrective lens</p> </div> </div>	
After having added glasses, production of explanations and conclusions	
Your hypothesis about the addition of a convergent lens is... <input type="checkbox"/> Confirmed <input type="checkbox"/> Refuted	Your hypothesis about the addition of a divergent lens is... <input type="checkbox"/> Confirmed <input type="checkbox"/> Refuted
What do you take away from this process (what is the most important thing to remember?) <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/> <hr style="border: 0; border-top: 1px solid black; margin: 5px 0;"/>	

Similarities between the human eye and the model of the eye



Complete the following table using the diagrams above

Identification number	Name of the corresponding structure in the human eye	Name of the corresponding component in the model of the eye (if possible)
1		
2		
3		
4		
5		
6		
7		

Proficiency of subject-specific knowledge targeted in the Progression of Learning

Limitations of the model of the eye

You have just highlighted the similarities between the human eye and the model of the eye. Though there are many parallels between the eye and the model, the latter does not behave like a human eye. Eyes are much more sophisticated.

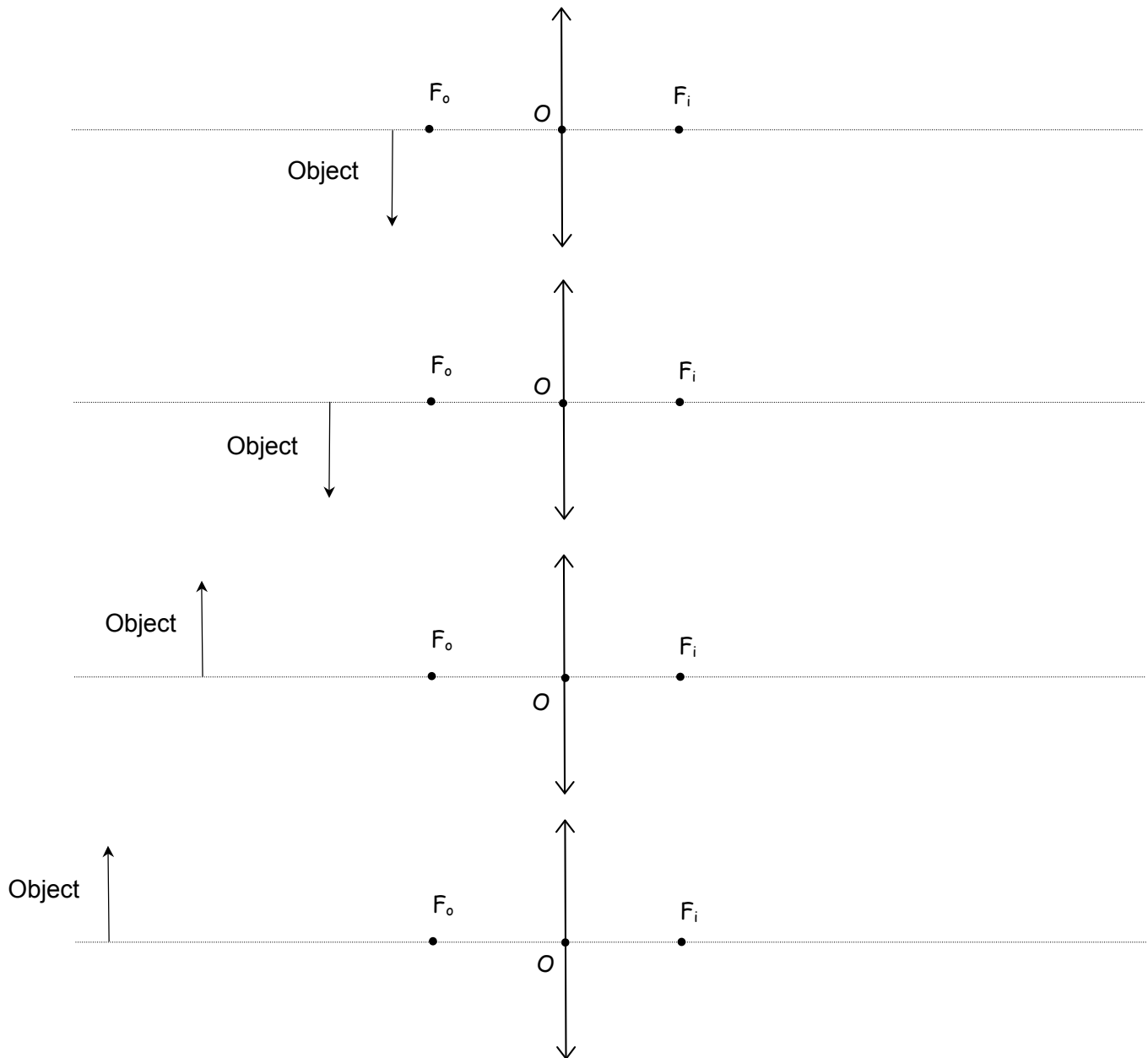
We therefore invite you to specify the limitations of the model of the eye, explaining what makes it imperfect. Which operations carried out by the human eye are not reproduced on the model?

Structure of the human eye	Component in the model of the eye	Explanation of the reasons the model is limited or imperfect
The assembly Iris — pupil		<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
Crystalline lens		<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>
Retina		<hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/> <hr/>

Proficiency of subject-specific knowledge targeted in the Progression of Learning	
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Locating images using diagramming

Fill in the following drawings by tracing two rays from the point of the arrow representing the object. The first ray must go directly through the peak (O). The second must be parallel to the main axis until the lens, then get deviated toward the focal point of the image (F_i). The image of the tip of the arrow appears at the intersection of the two rays. Draw the image formed in the correct direction and position.



On the drawings from the previous page, in which direction do the formed images appear? Is this consistent with your observations of the model?

Carefully observe the progression in the four images drawn on the previous page. At which position would an image placed to the left at a very great "infinite" distance, appear?

In everyday life, what size does a very distant object appear to us? Is this consistent with the drawings on the previous page?

When you look at the sky on a starry night, how big do the stars seem? How do we perceive them?

Anomalies or illnesses of the human eye (enrichment)

We now invite you to use your abilities and knowledge acquired to push your understanding of the human eye a little further. To do so, you must produce a document that may take the form of a PowerPoint presentation, a poster or simply a text.

The document must explain one of the following anomalies or illnesses of the eye and how to treat them:

Anomalies

- Myopia
- Hypermetropia
- Astigmatism
- Presbyopia

Illnesses

- Cataracts
- Glaucoma
- Macular degeneration
- Retinal detachment

Work plan