WS20

Simple magnifier

Exploration:

You have three lenses. Examine them carefully noting the curvature of the surfaces. Based on this examination, rank the lenses in terms of increasing focal length.

BEFORE you use each of the lenses as a magnifier, **predict** which lens do you think will magnify more? Why?

Use each lens as a magnifier. Start with the lens close to the surface of the page and then move the lens back.

At what distance from the object does the maximum magnification occur?

Is there some maximum distance from the surface with which the lens can be used? If so, is there a physical reason for this specific distance?


When using the magnifier, where is your eye focusing (closer to you than the object, at infinity, etc.)?

Where is the image formed by the magnifier located? What type of image are you using?

Magnifying glass

The normal eye has the ability to change its focal length so that we can see objects close up or far away. When the eye is relaxed, the object distance to form a clear image is very far away – infinity. When the eye is tensed, it is focusing on near objects. For the normal eye, the near distance is considered 25 cm and the far distance is considered ∞.

If you were to place an object as close as possible, and still form a clear image, that object would subtend some angle.
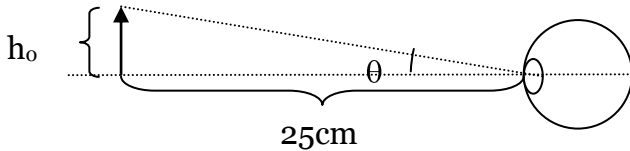
Consider a simple magnifier. The object is placed inside the focal point. For the situation shown below, where is the image located?
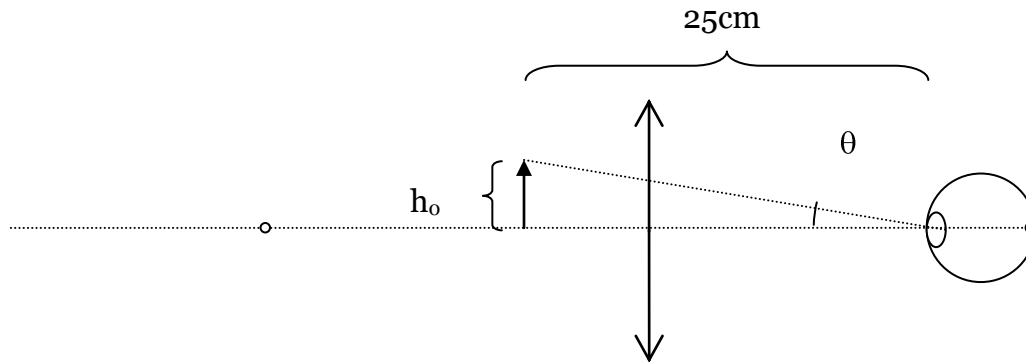
Compare the angle that the object subtends without the lens, with that subtended by the image. Could you somehow use the angles to determine a magnification? If so, why would that work? If not, why not?

How close could you move your eye and still have the image be in focus? Would this change the angle subtended by the image?

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Write an expression for the maximum angular magnification you could achieve with a lens of focal length f and the image viewed at the normal near point of the eye.

Imagine you move the object closer to the focal point. What happens to the image size? What happens to the angle the image subtends?

If the object were at the focal point, where would the image be located? Could you see this image? What would the magnification be in that case?

Write an expression for the angular magnification in which the image is at infinity and the eye is relaxed.