Phys 112 2019

Lecture 33

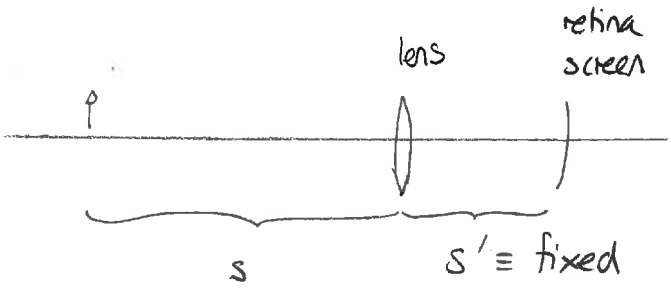
Mon: Warm Up 13

Tues: Review III

Weds: Exam III Covers Ch 25.5, 25.7, Waves
Ch 17, Ch 18, Ch 19 (so far)

Human vision

The human eye uses a converging lens in order to create images on the retina, which is a fixed distance from the lens. The lens can adjust, changing its focal length so as to be able to form clear images of objects at many locations. In all cases



$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f}$$

Thus

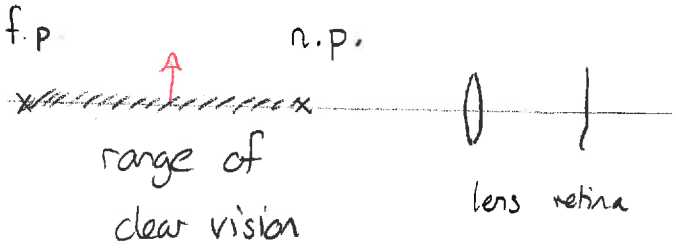
> As object to be viewed approaches the eye, the lens focal length must decrease and the lens must become more curved.
>
> As object to be viewed moves further from the eye, the lens focal length must increase and the lens becomes less curved.

There are two extremes for clear vision

1) near point - closest point at which object can be so that a clear image is formed.

2) far point - farthest point at which object can be so that a clear image is formed

The lens can make a clear image of any object between these points



Vision deficiencies

Two common vision deficiencies are:

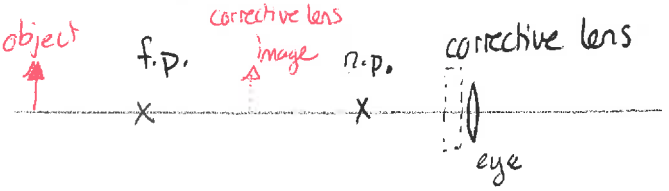
1) nearsightedness (myopia) - cannot see distant objects clearly.

2) far sightedness (hyperopia) - cannot see close objects clearly

See p 664-665

Each deficiency is correct by placing a single lens adjacent to the eye. The process is

1) object is outside of clear vision range
2) lens creates an image between f.p. and n.p.
3) the eye observes the image and can see this clearly

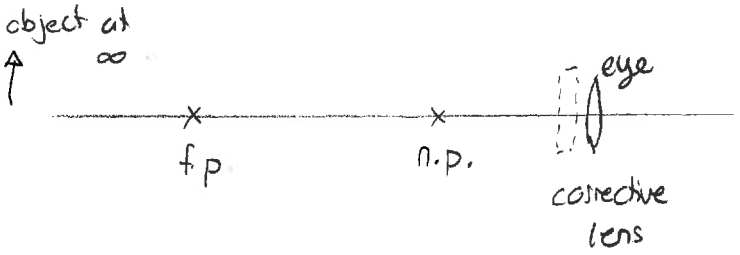


The image must:

1) be upright
2) have an angular size approximately the same as the object.

Nearsightedness

Nearsightedness results from a situation where the far point is no longer infinitely distant. The procedure for correcting this is: to use a corrective lens that



1) produces upright images
2) takes an object at ∞ and produces an image at the f.p.

Quiz 1

120 Nearsightedness

A nearsighted person has a far point of 1.5 m and a normal near point of 0.25 m. A single corrective lens is used to allow that person to view objects that are infinitely distant. Assume that the lens is placed against the eye.

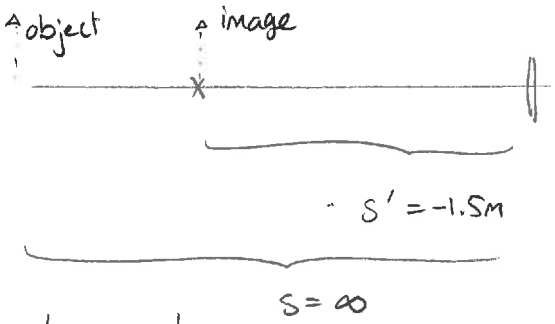
a) Determine the focal length of the lens so that the person can view an object that is infinitely distant. Is the image of this object (created by the corrective lens) larger or smaller than the object?

b) Determine the location of the closest object that the person can see clearly!

c) With this corrective lens, what is the range of vision of the person?

Answer: a) We need object at ∞

image at f.p.



$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \quad \Rightarrow \quad \frac{1}{\infty} + \frac{1}{-1.5m} = \frac{1}{f}$$

$$\Rightarrow \quad f = -1.5m$$

b) We need image at n.p. Where is object? $s' = -0.25m$

$$\frac{1}{s} + \frac{1}{s'} = \frac{1}{f} \quad \Rightarrow \quad \frac{1}{s} = \frac{1}{f} - \frac{1}{s'} = \frac{1}{-1.5m} - \frac{1}{-0.25m}$$

$$= 3.3\ m^{-1}$$

$$\Rightarrow s = \frac{1}{3.3\ m^{-1}} \Rightarrow \quad s = 0.30m$$

c) Range $\infty \rightarrow 0.30m$ near pt shifts further