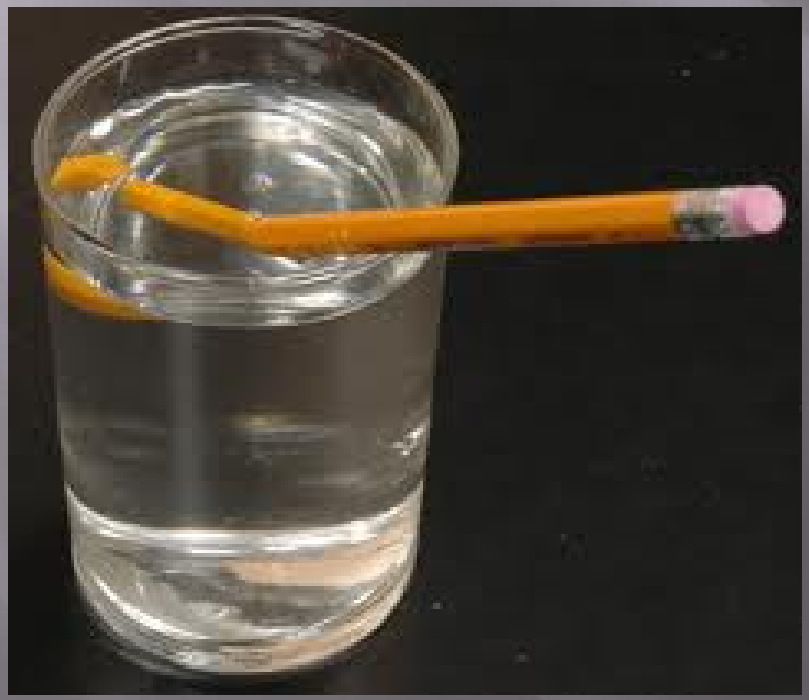
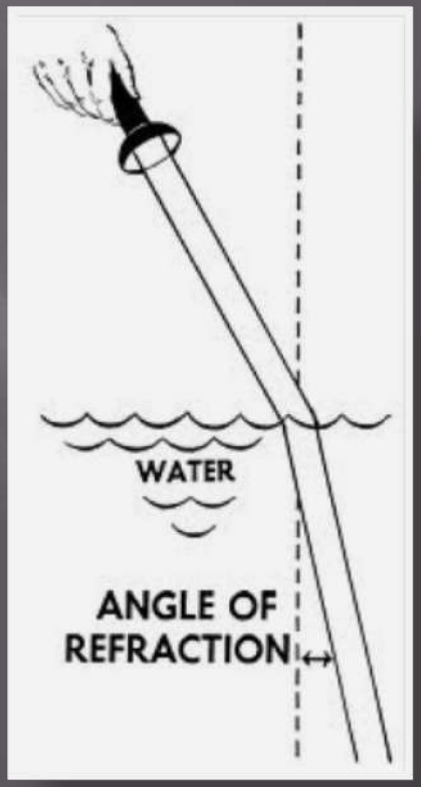
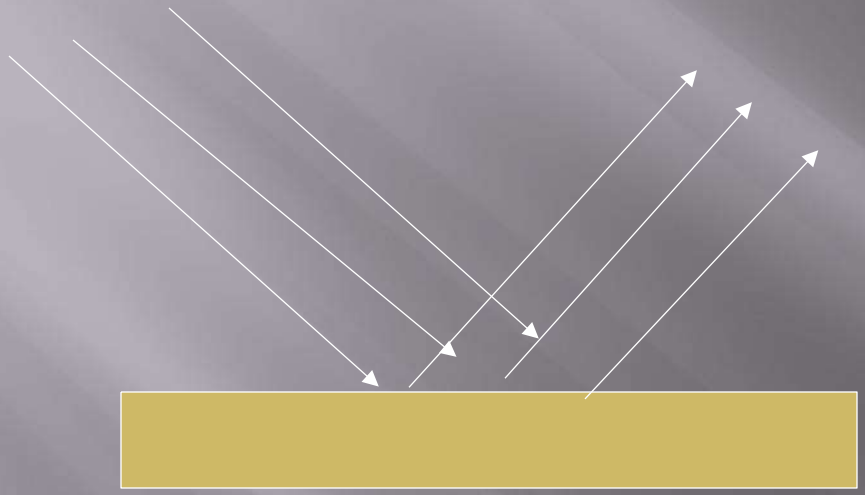
LENSES

Refraction is the bending of light when it moves from one matter to another





REFLECTION



Reflection is the bouncing of light off an object

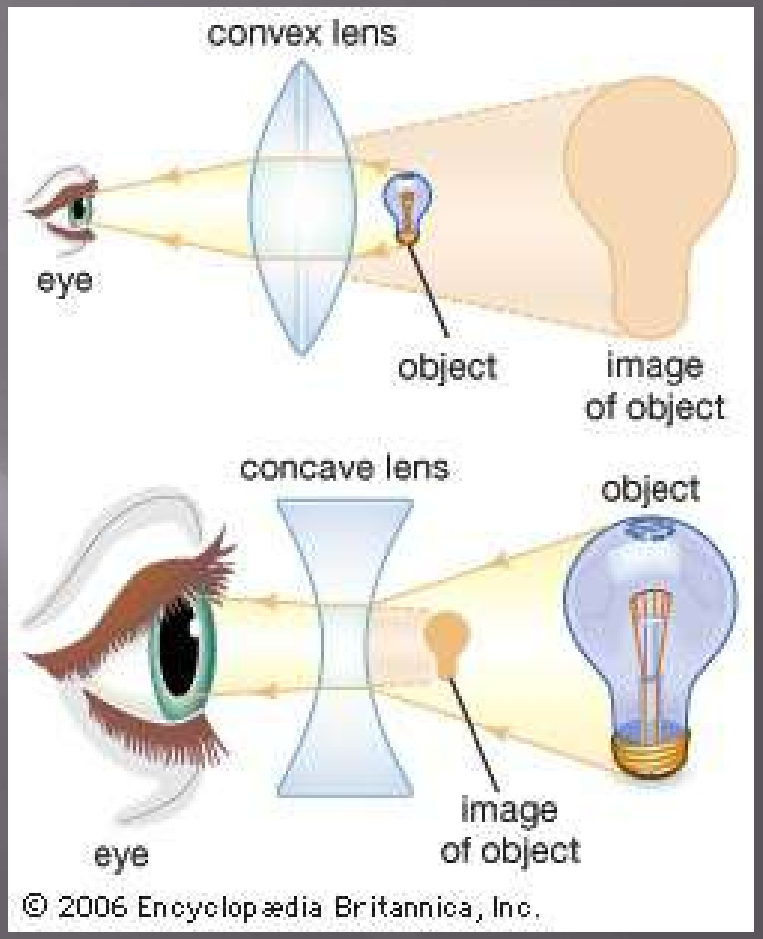
Refraction occurs in both concave and convex lenses.

A lens is a piece of material in which light is able to pass through and is used to refract light.

Lenses and Images

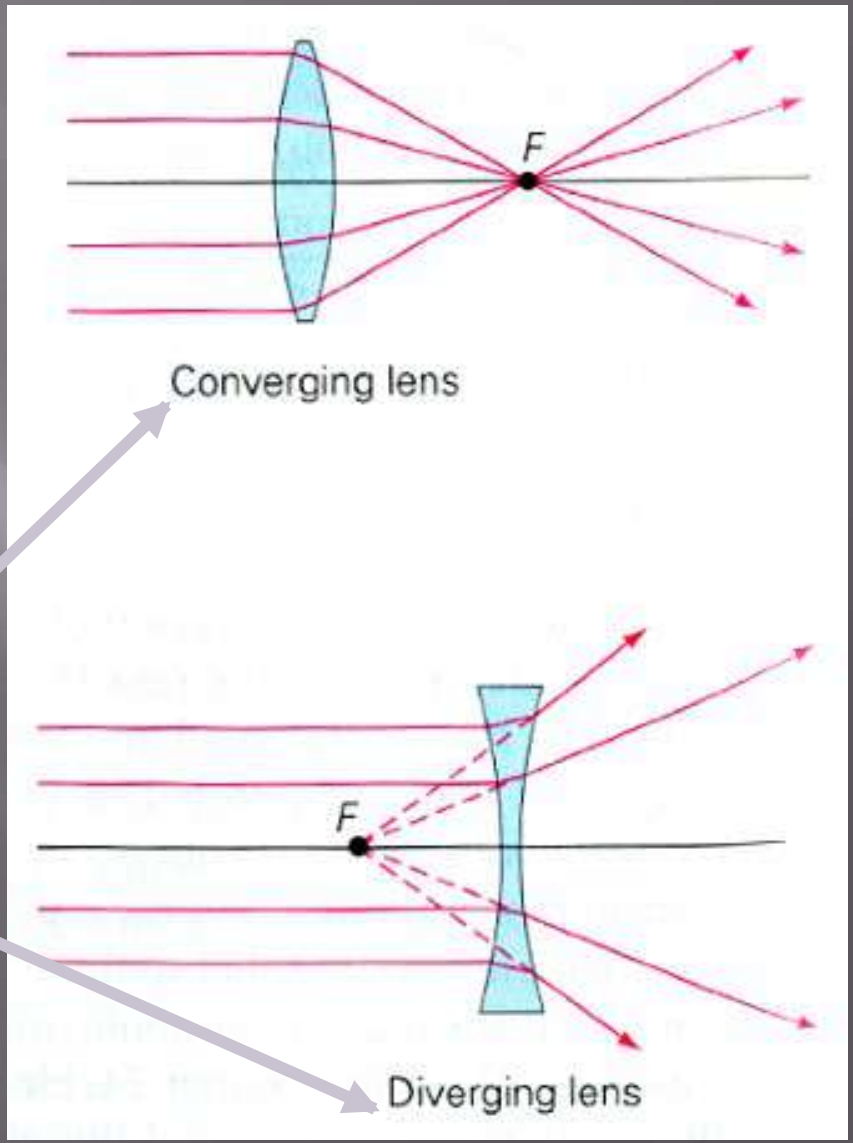
A lens forms an image by REFRACTING light rays that pass through it.

The type of image formed by a lens depends on the shape of the lens and the position of the object.



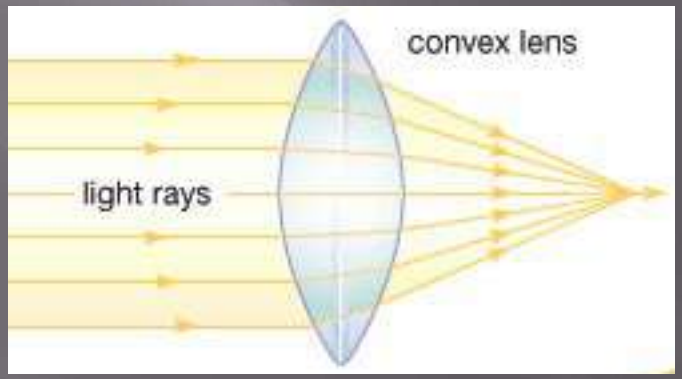
TWO TYPES OF LENSES

- There are 2 types of lenses:
  1. CONVEX
  2. CONCAVE



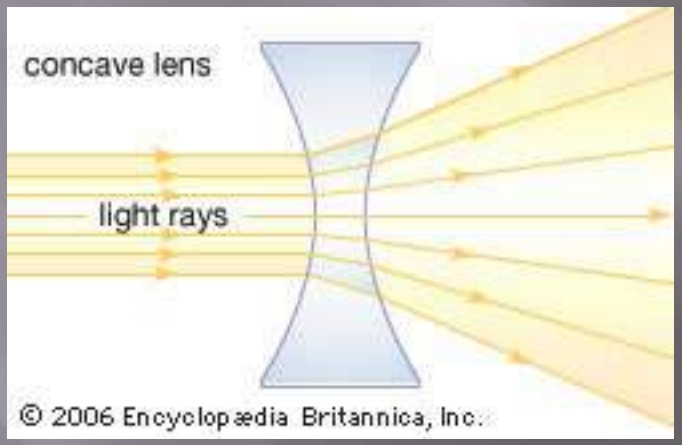
Convex Lens

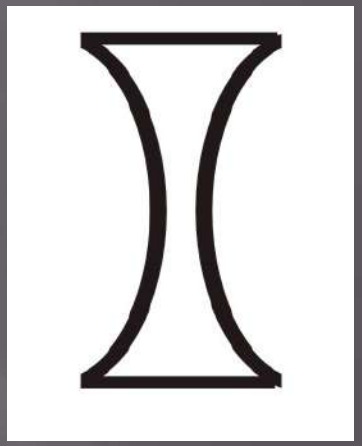
- A convex lens or magnifying glass is thicker in the middle then on the ends which causes the light rays focus (converge)



Concave Lens

- A concave lens is thinner in the middle than at the edges and causes light rays to spread apart (divergence)

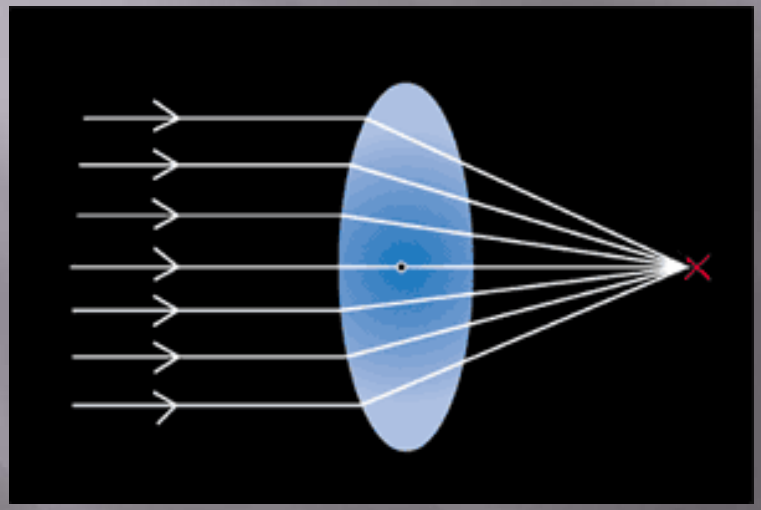




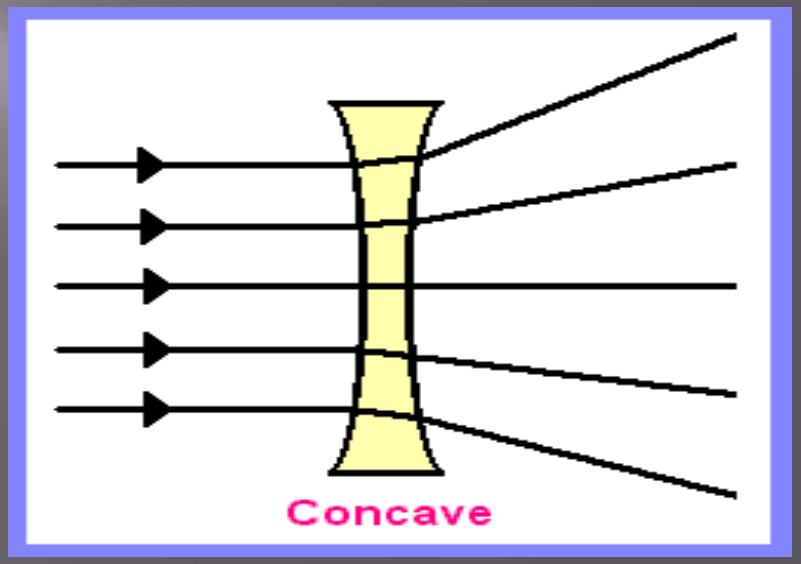
It looks like there is a cave on both sides!! So, it must be concave!!

CONCAVE AND CONVEX LENSES

A CONVEX LENS CAN FOCUS THE LIGHT THAT ENTERS IT AND DIRECT IT TO ONE POINT.



CONCAVE LENSES MAKE LIGHT RAYS MOVE AWAY FROM EACH OTHER OR SPREAD OUT



Convex Lenses and Images

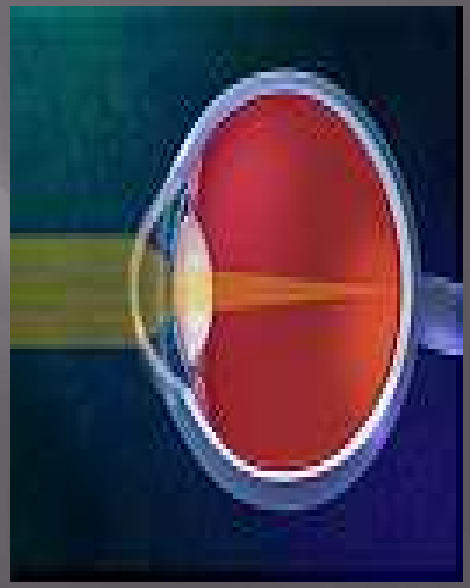
- Depending on where you hold the lens--the image you see will either be right side up (real image) or upside down(virtual image)

Concave Lenses and Images

- A concave lens produces upright images that are smaller than the real object.

Examples of CONVEX lenses

1. Magnifying glass
2. Cameras
3. Telescopes
4. Our Eyes
5. Glasses



Example of CONCAVE lenses

- Nearsighted eyeglasses
  (can't see far away)

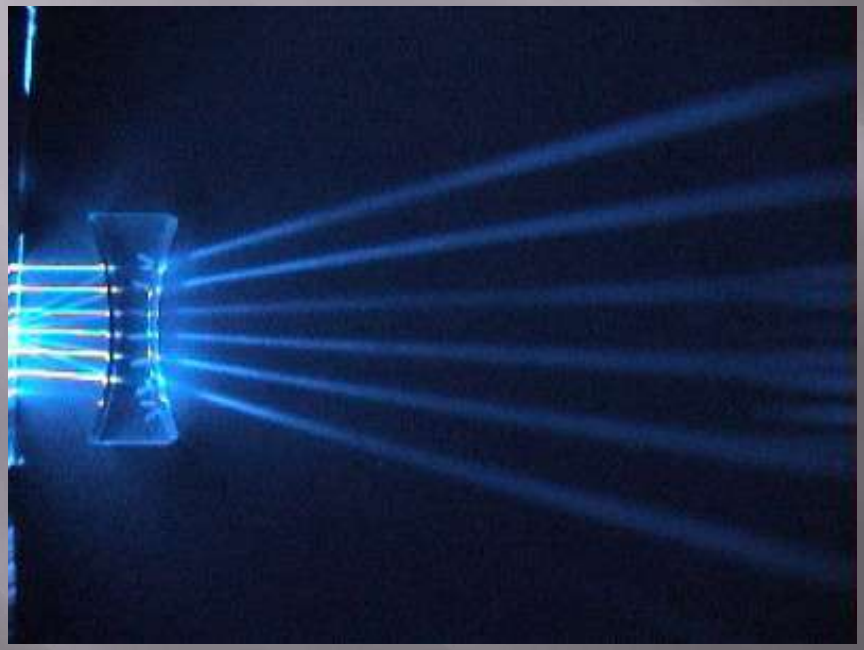
Water Lens Experiment

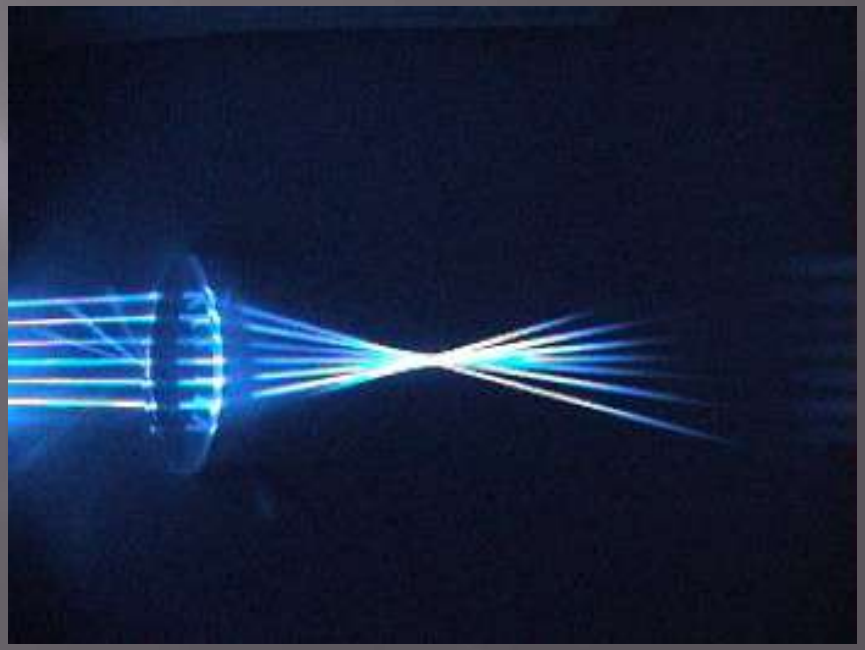
Make Hypothesis

Which lens converges light?

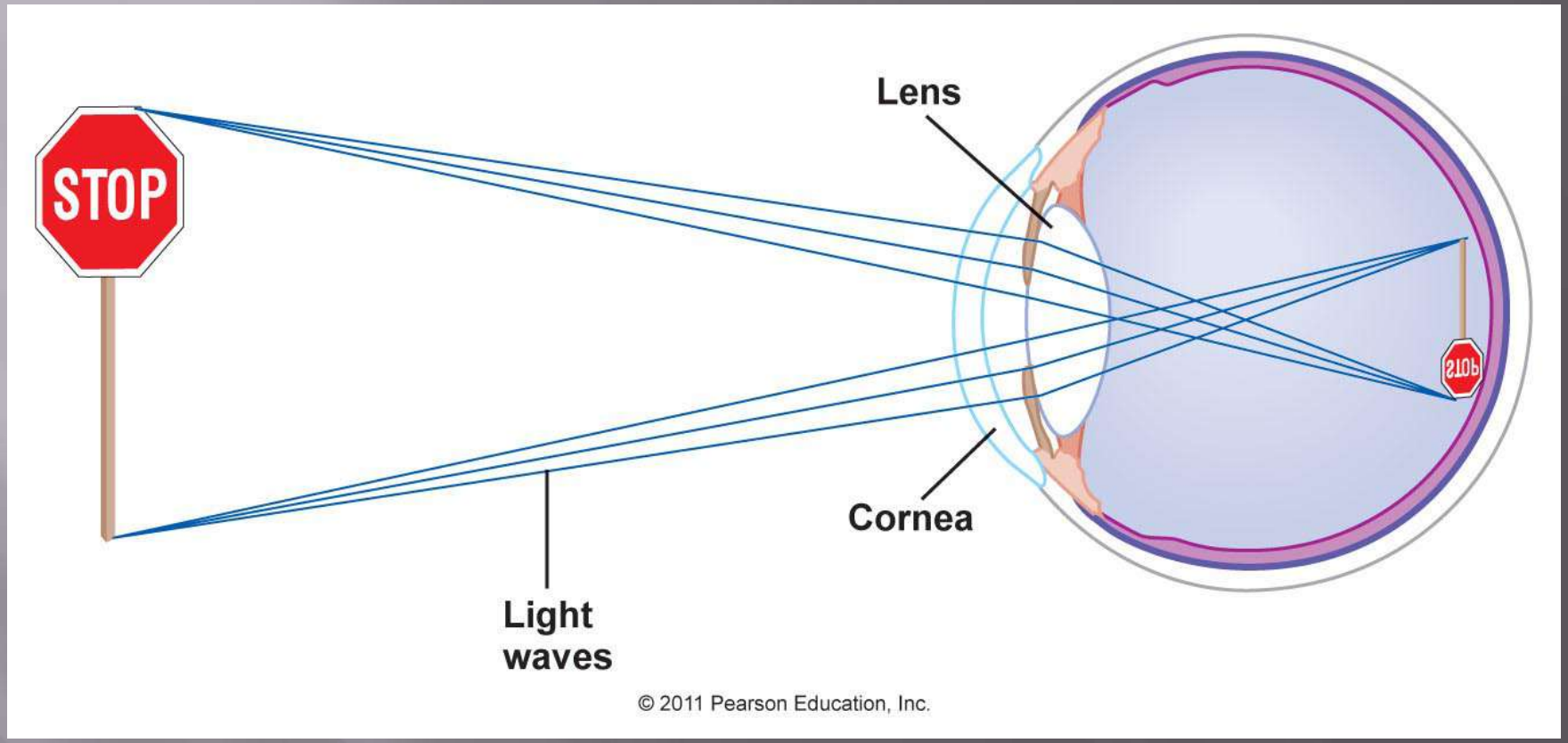
Which lens diverges light?

Which is concave and which is convex?





Your 2 Lenses: Cornea and Lens

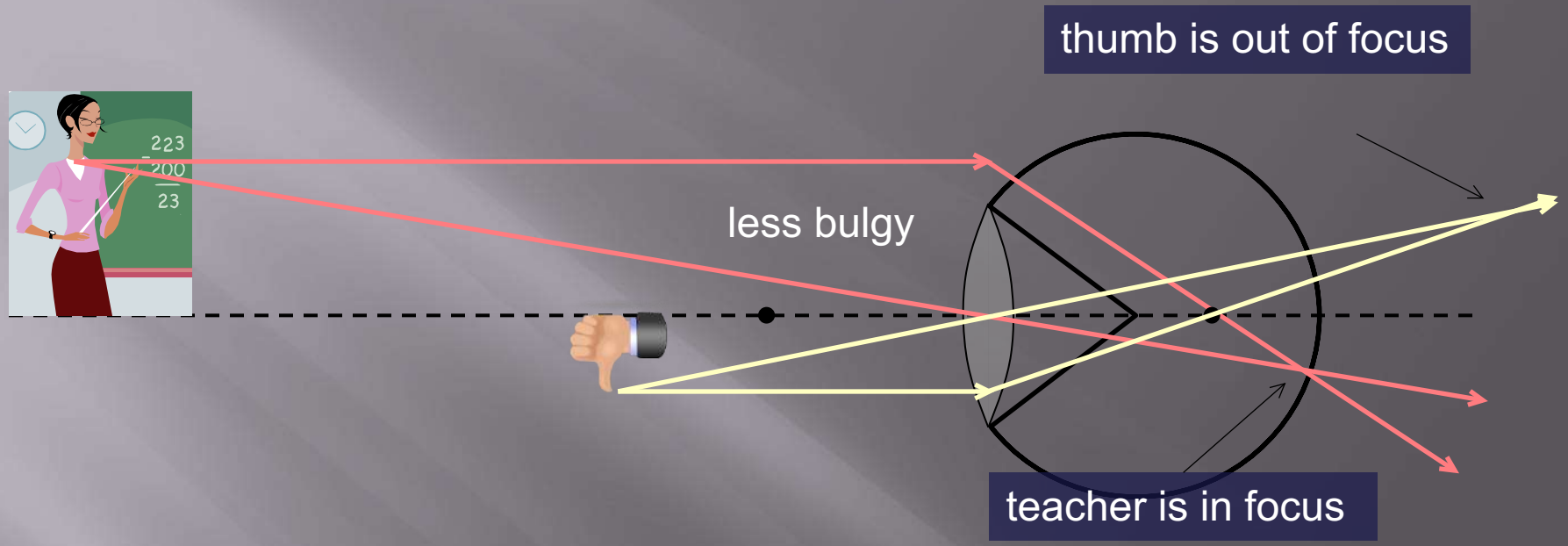


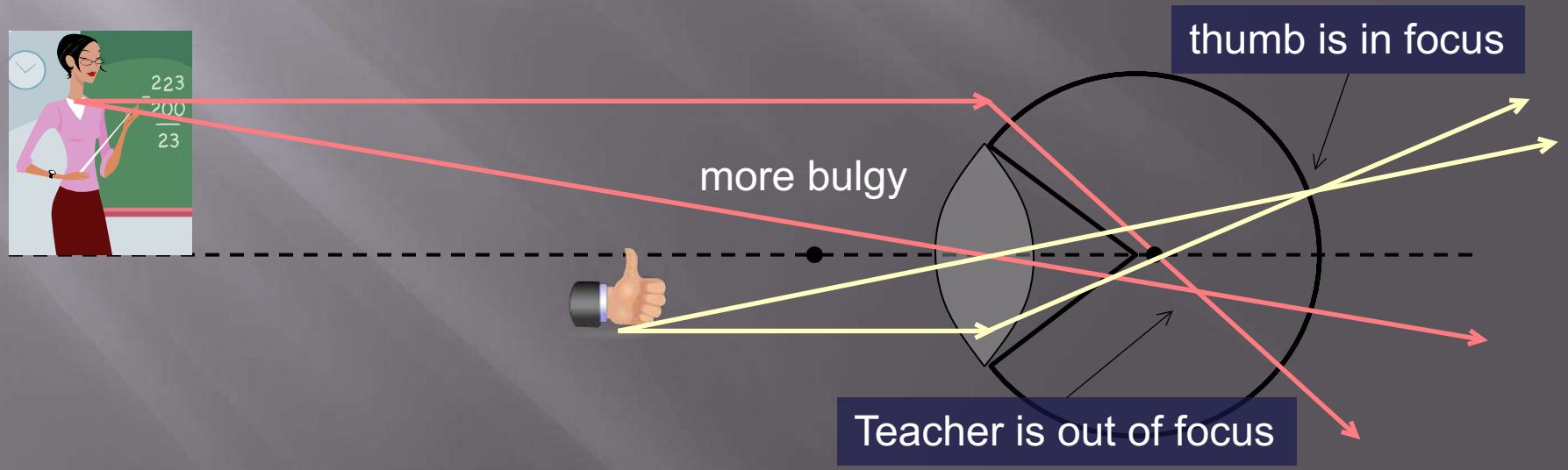
- There are two lenses in your eye, the cornea and the lens.
- The cornea, the front surface of the eye, does most of the focusing in your eye
- The lens provides adjustable fine-tuning of the focus

FUNCTIONS:

How Your Lens Focuses

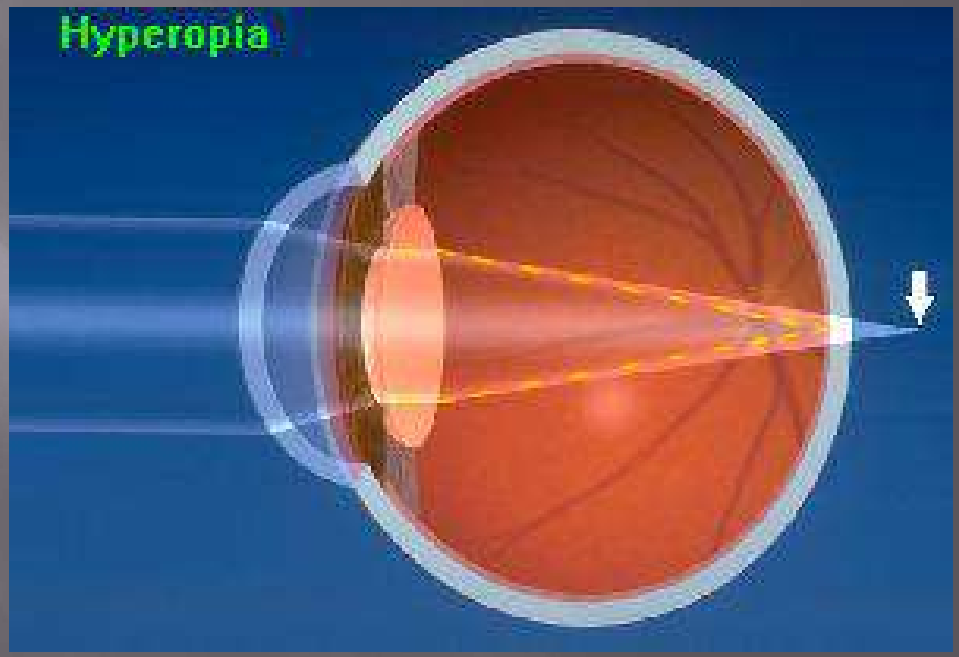
- Your lens has a *small depth of field*
  - You can't see something close and far with both objects in focus at the same time
- Hold out your thumb about a foot away from your eye
  - Then, alternately focus on thumb and me (right above your thumb)
- Note that you cannot see *both* me *and* your thumb sharply (in focus) at the same time
  - You focus on one or the other by changing the bulge of your lens


thumb is out of focus
223
200
23
less bulgy
teacher is in focus

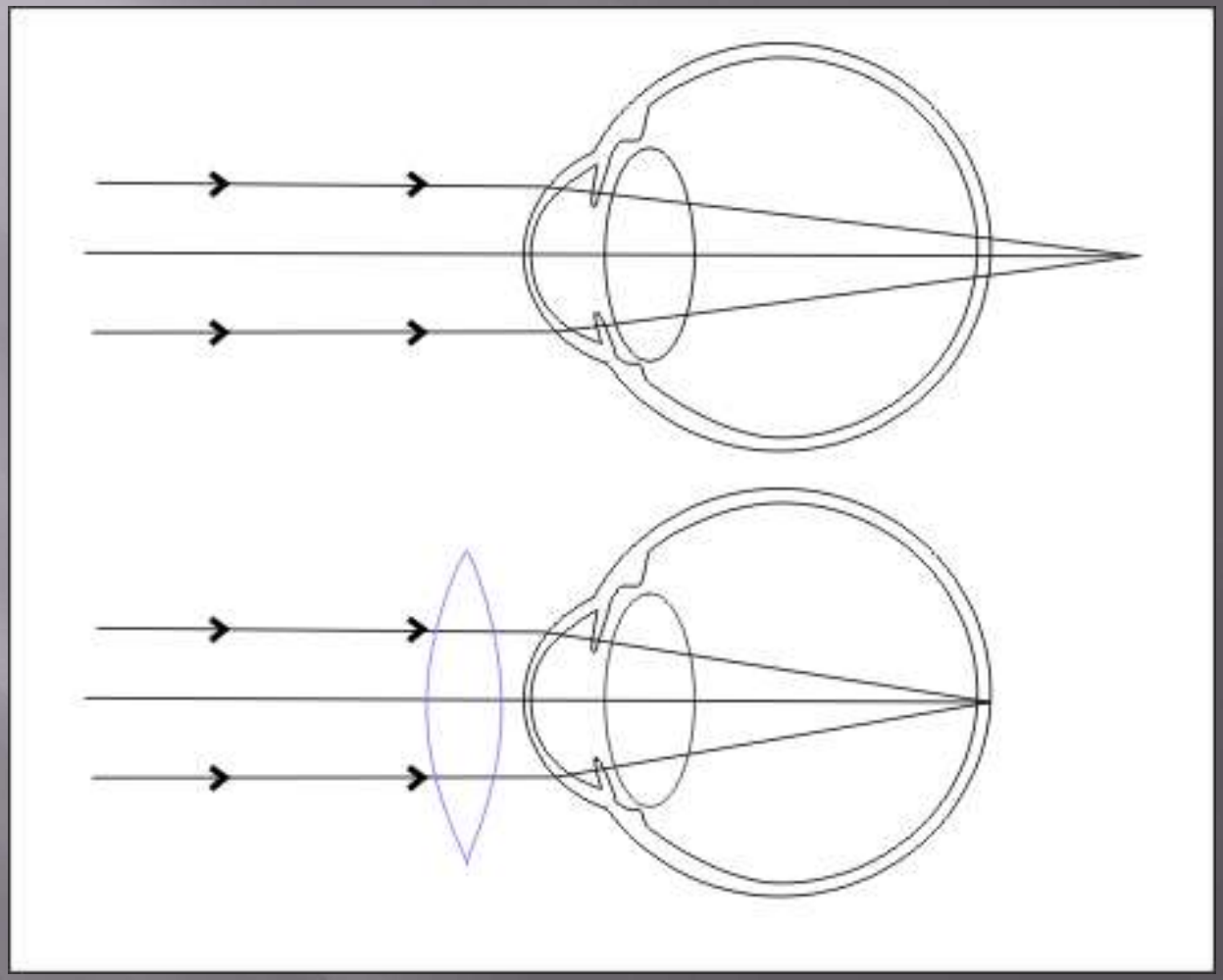

thumb is in focus
223
200
23
more bulgy
Teacher is out of focus

HYPEROPIA-Far-sightedness

- Problem seeing close objects
- Distance between lens and retina too small
- Light focused behind retina
- Corrected with converging lenses

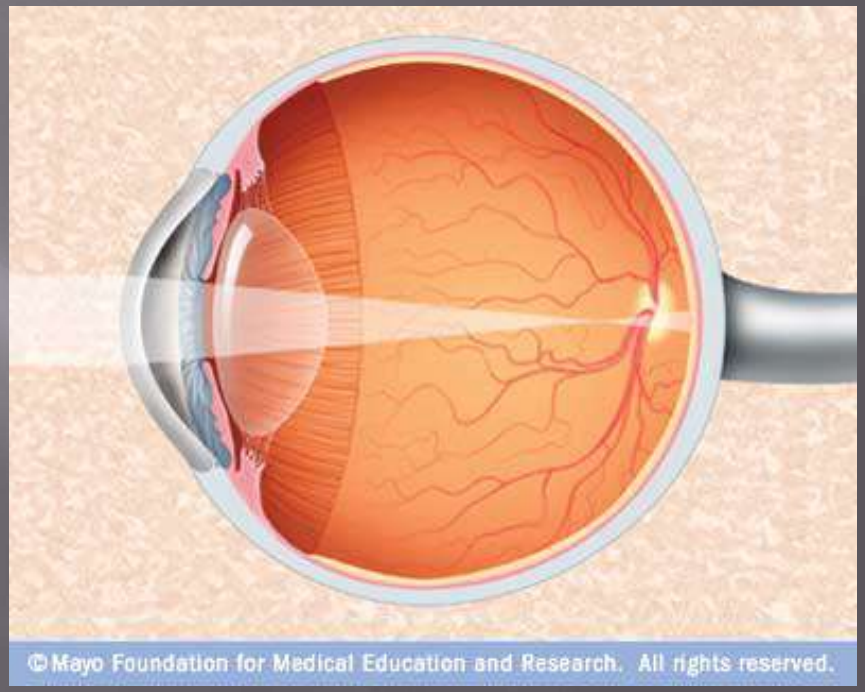


Far-Sighted (Hyperopia)

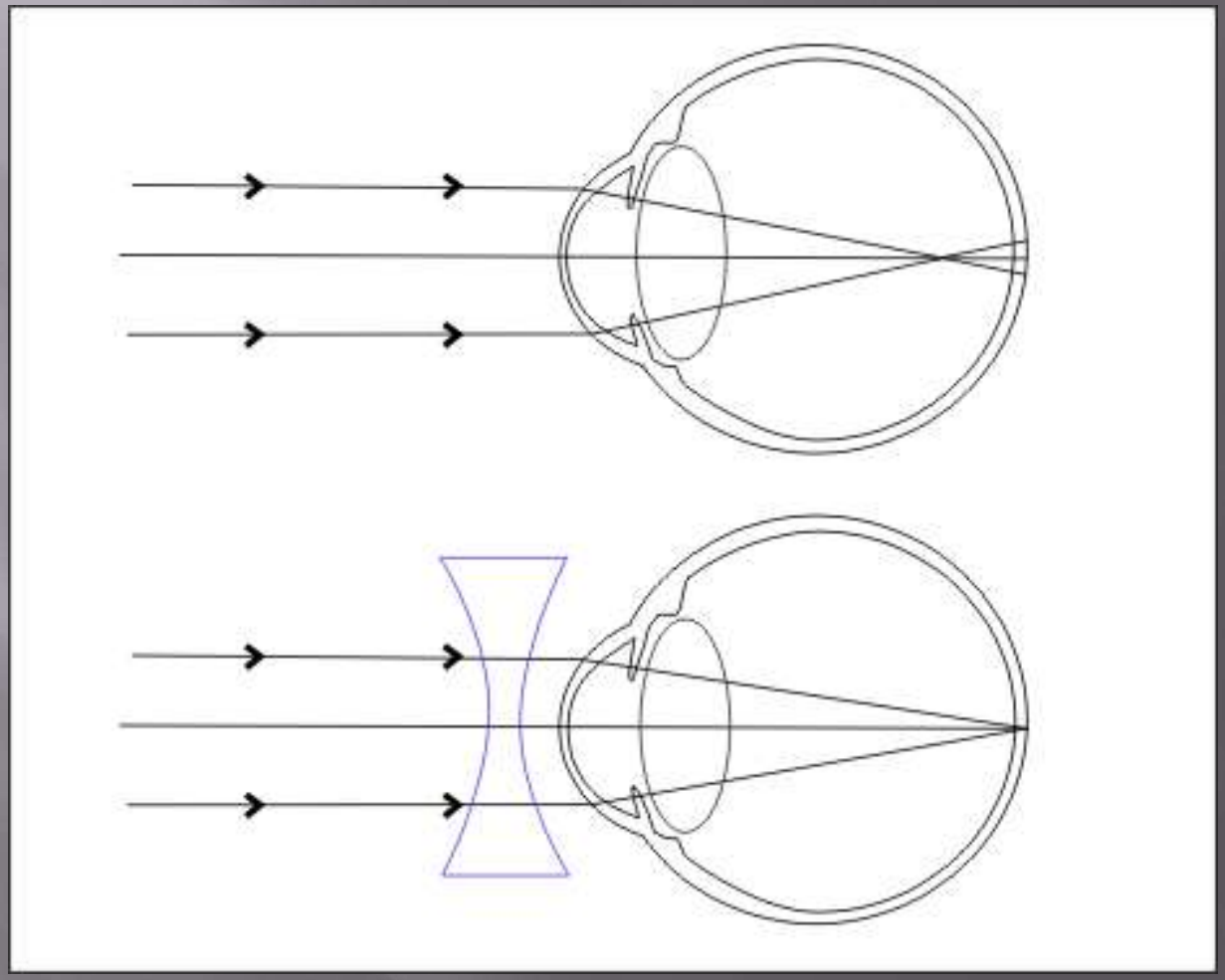


MYOPIA-Near-sightedness

- Problem seeing objects far away
- Distance between lens and retina too large
- Light focused in front of retina
- Correct with diverging lenses



Near-Sighted (Myopia)



LENSES AND VISION

NEARSIGHTED- DIFFICULTY IN SEEING OBJECTS FAR AWAY

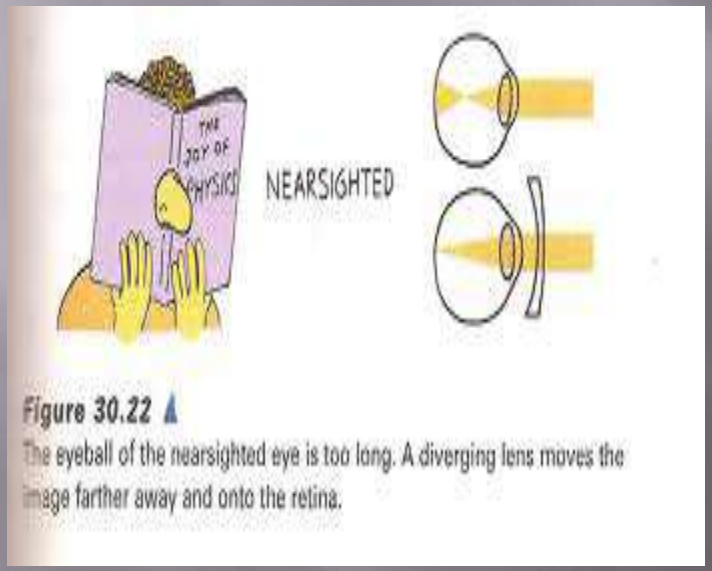


Figure 30.22
The eyeball of the nearsighted eye is too long. A diverging lens moves the image farther away and onto the retina.

Concave Lens

FARSIGHTED- DIFFICULTY IS SEEING OBJECTS UP CLOSE

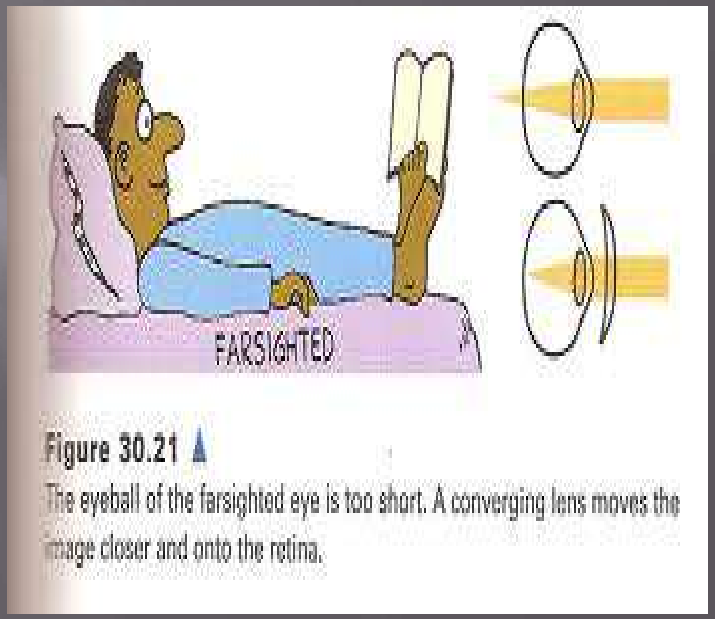


Figure 30.21
The eyeball of the farsighted eye is too short. A converging lens moves the image closer and onto the retina.

Convex Lens

Videos

"How Eyes Work: An Introduction" (10:48)
http://www.youtube.com/watch?v=SCn83DHC1Ug

Bill Nye The Science Guy on the Eyeball (2:12)
http://www.youtube.com/watch?v=cFVbLnXWn6A

"How the Human Eye Works"
http://www.youtube.com/watch?v=fn6v3SkH0LI

The Human Eye and How it Works (22:59)
http://www.youtube.com/watch?v=28NysX8JHDo