



Light and Lenses:

How Do Your Eyes Help You See?

What is refraction?

- **Refraction** is the bending of light when light travels from one material to another material
- Where can refraction take place?

Let's Review

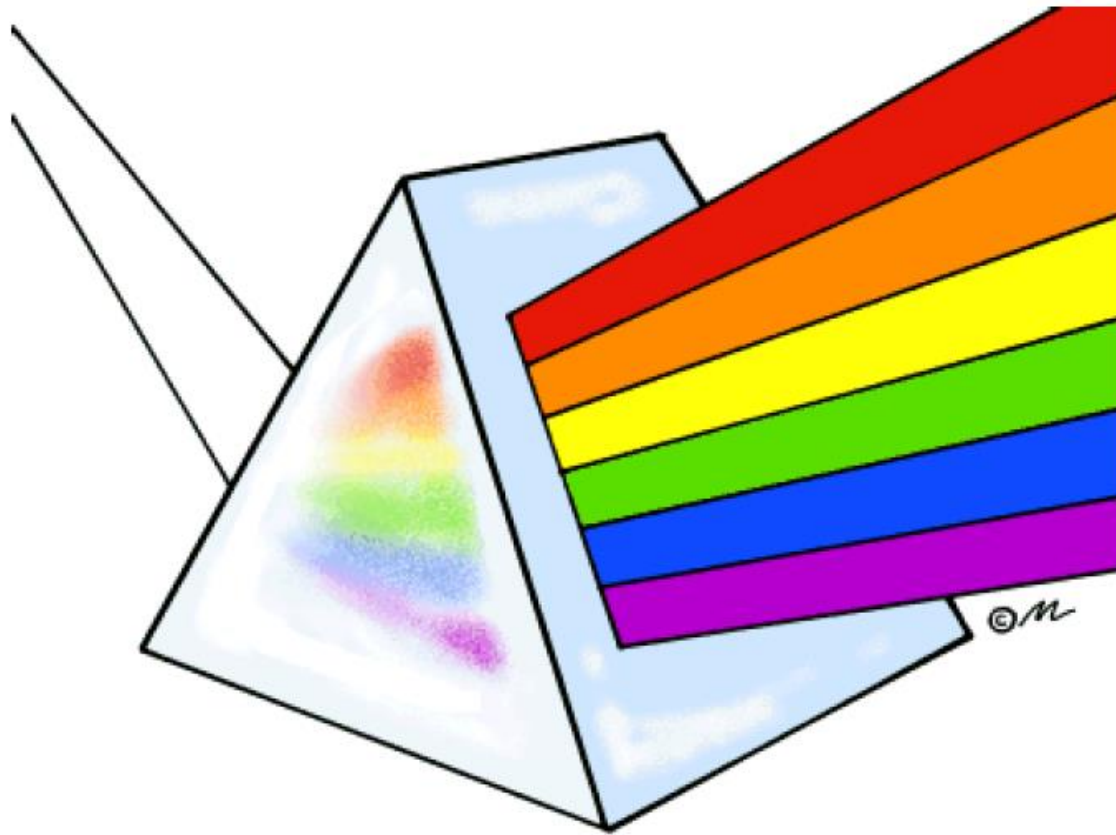
Prisms

Most of the light that you see is white light.

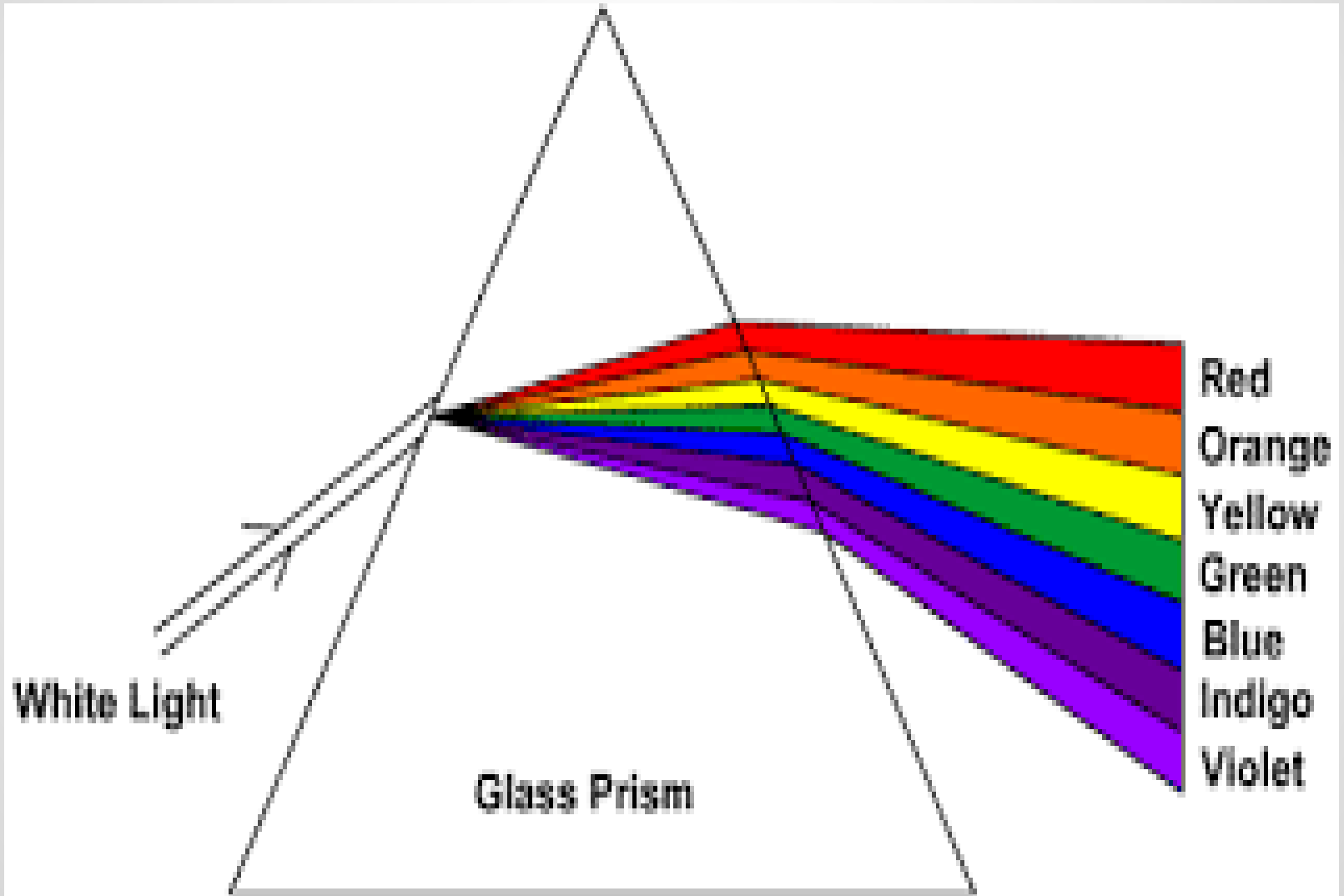
- White light is made up of different colors of light mixed together.
- A prism is a clear object that splits white light into all the colors of the rainbow.
- Most prisms are made of clear glass or plastic.
- They have flat, polished sides.

A prism works by refraction.

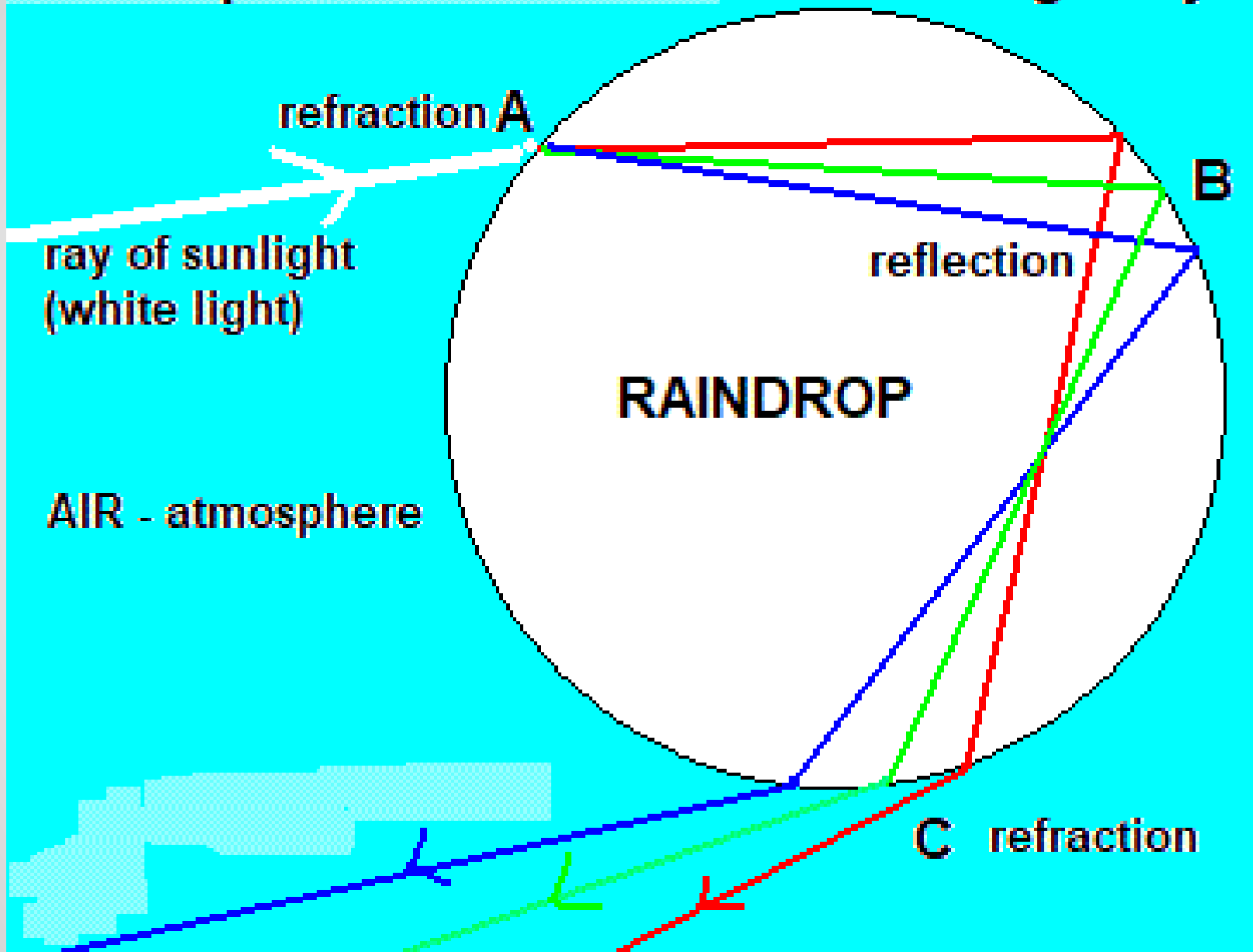
- When white light passes through a prism, each color of light takes a different path.
- In other words, some colors of light bend more than others.



The visible spectrum – the colors we can see (ROYGBIV)



Raindrop - refraction and reflection of light rays



Refraction in lenses

- Besides prisms, there are many other objects that refract (bend) light.
- Let's investigate other objects!



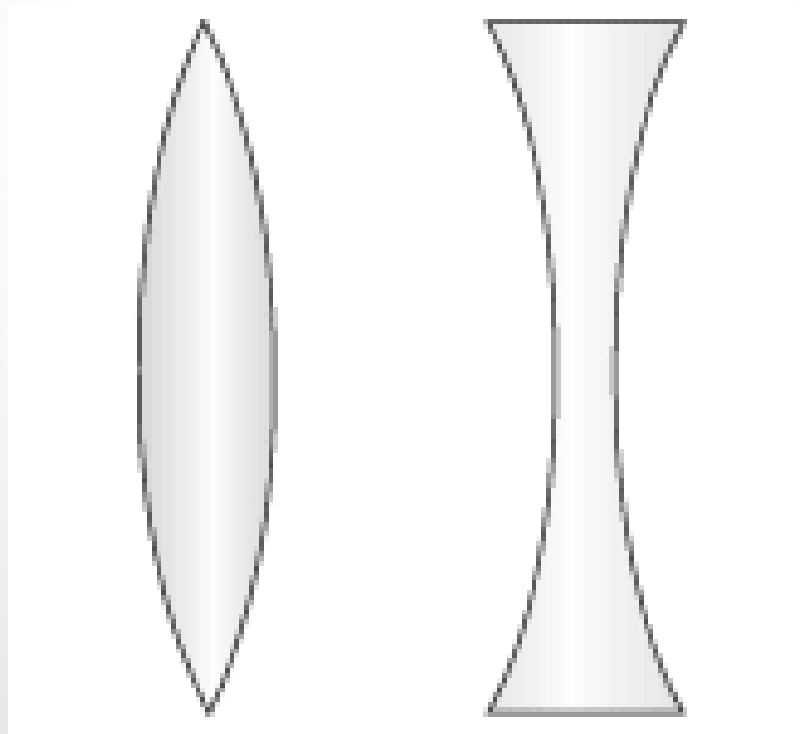
What is a lens?

- A lens is a curved surface, like a piece of glass or plastic.
- Its curved shape makes light bend.
- Lenses can make objects appear bigger or smaller to our eyes.





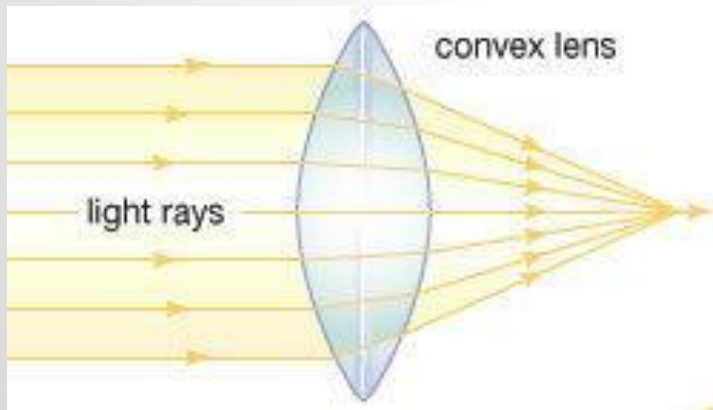
We just observed two types of lenses. Who knows what these two lenses are called?



...Convex and Concave Lenses!

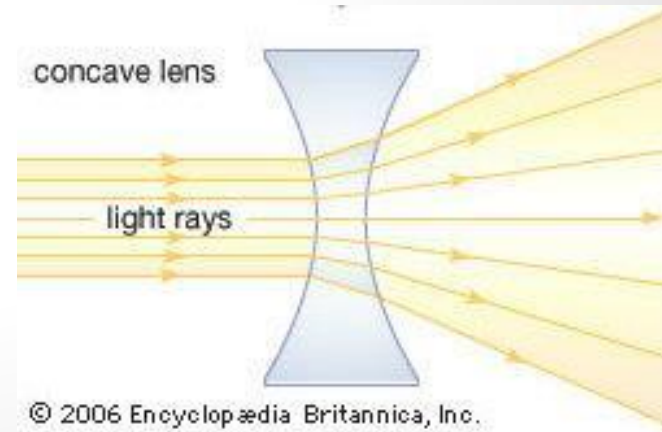
Convex Lenses

- curve outward
- make light converge
- make images appear bigger



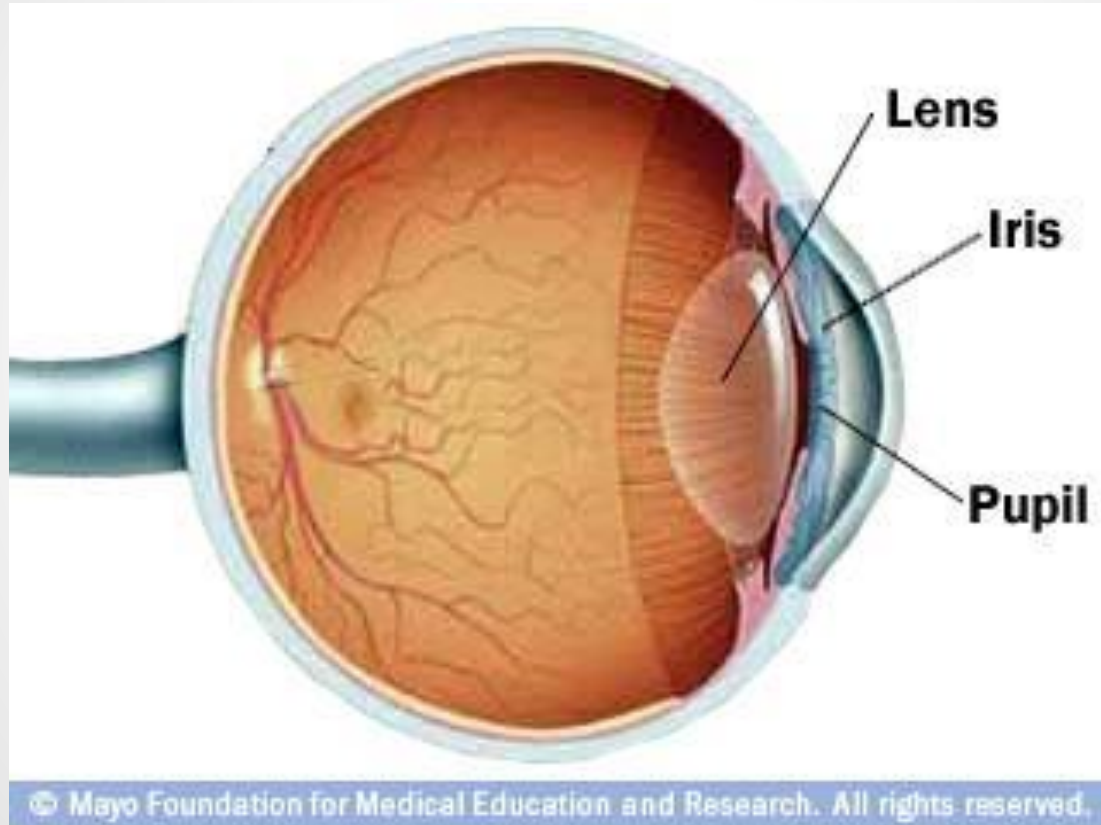
Concave Lenses

- curve inward
- make light spread out
- make images appear smaller

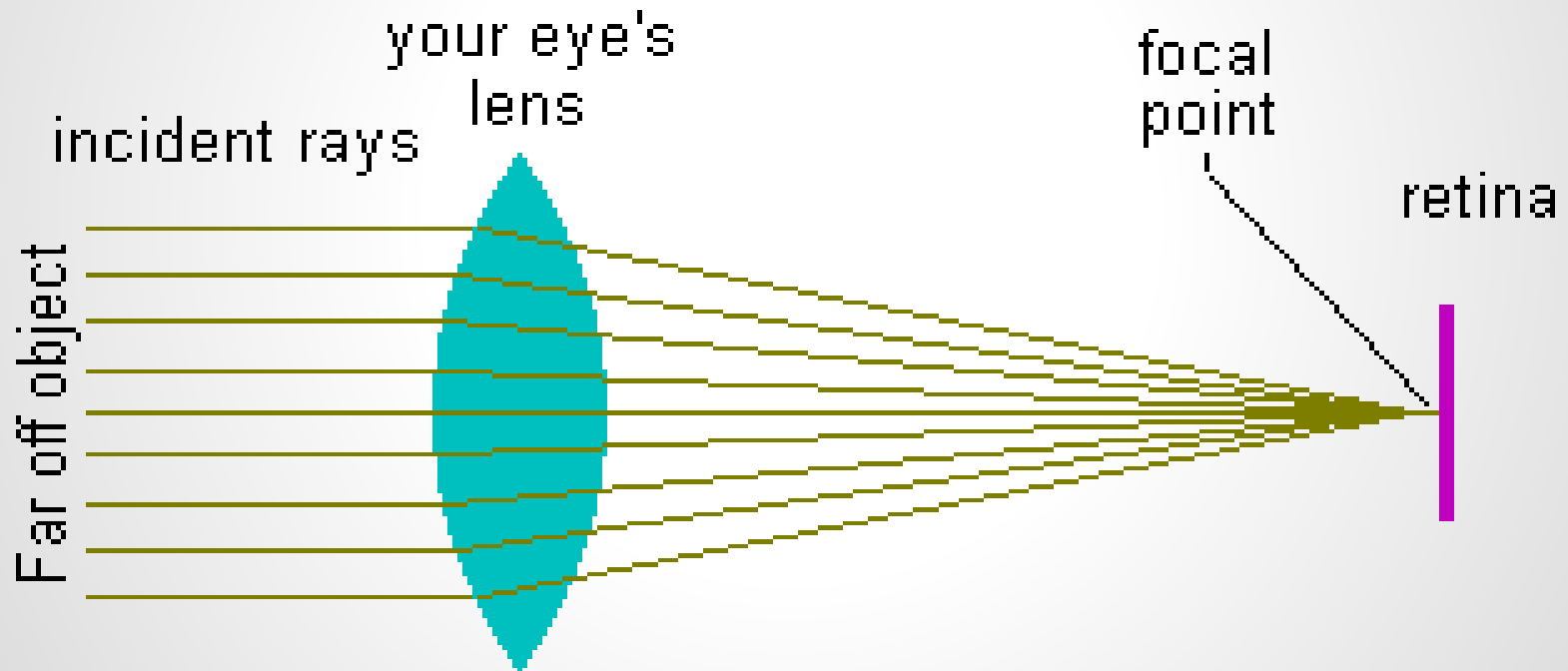


Watch: [Bill Nye Lenses Video](#)

Our eyes have lenses that help us to see the world around us!

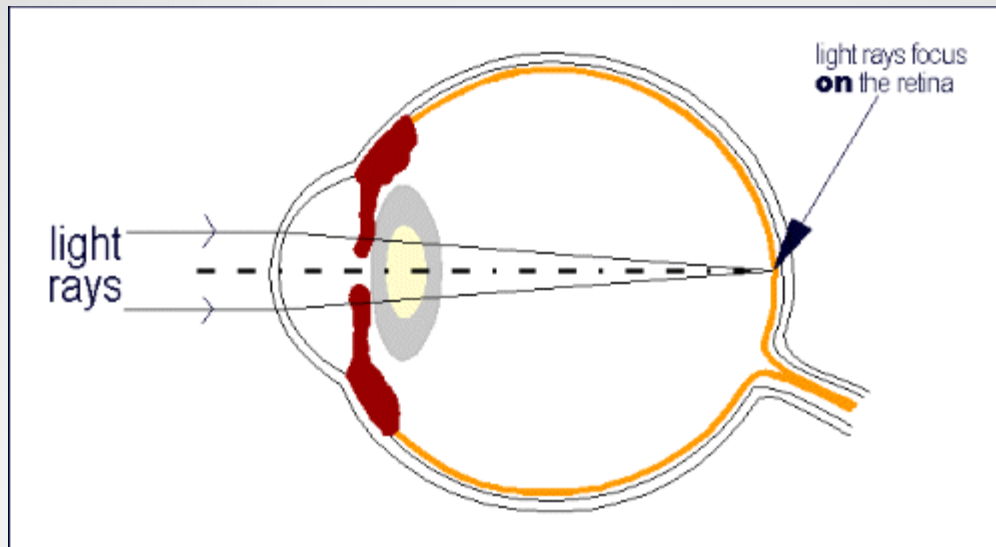


Here is a model of the lens in your eye:



What type of lens is in your eye?

- a) Prism
- b) Convex Lens
- c) Mirror
- d) Concave Lens



The convex lens focuses light rays onto the retina, which has cells that detect light.



**Fun Fact! The image projected in our eye is actually upside down!
The brain flips the image back to its original state.**

Let's Review!

- Lenses make objects appear bigger or smaller.
- The lens in our eye is a convex lens.
- Many parts of our eye manipulate the path of light to help us see images.
 - The iris controls how much light enters the eye,
 - the ciliary muscle controls the shape of the lens,
 - and the optic nerve transmits images to the brain.

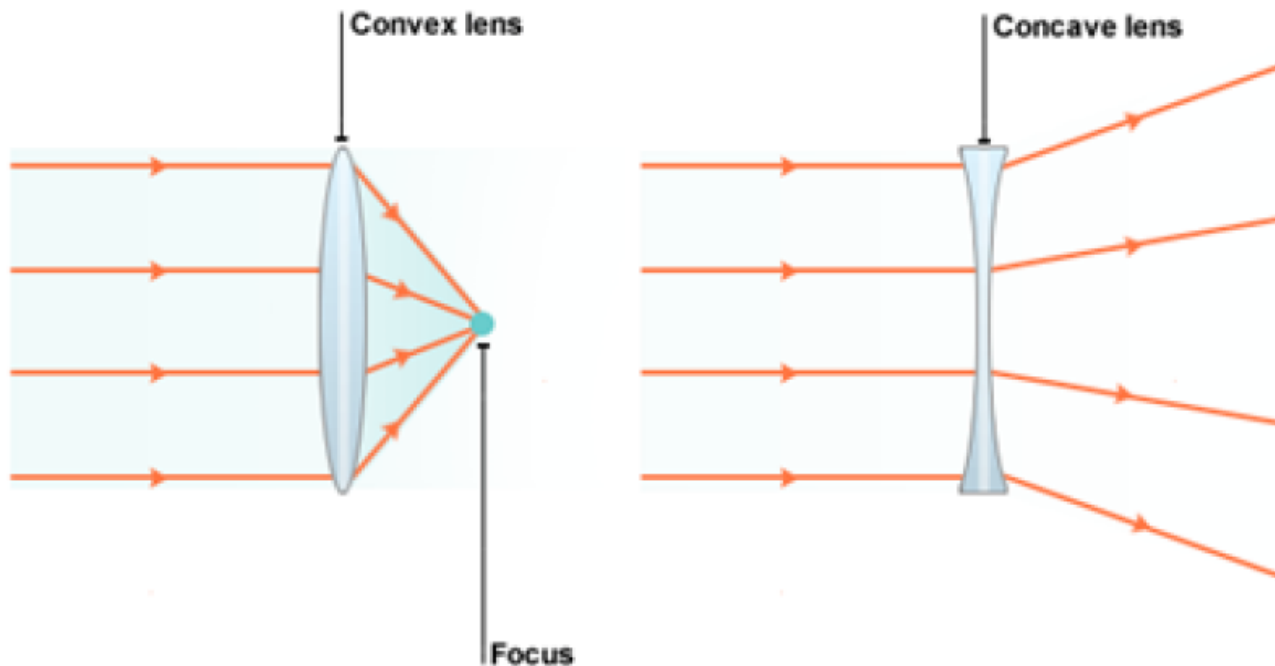
Lenses Review

Lenses

- A lens is a clear material with at least one curved surface.
- They are used to change the direction of light. How light bends depends on the shape of the lens.

There are two main types of lenses- convex and concave.

- A **convex lens** is thicker in the middle than at its edges. It bends light inward. The light bends toward a point called the focus.
- A **concave lens** is thicker at the edges than in the middle. A concave lens bends light outward.



Real World Usages

Yesterday, we talked about how our eyes are an example of a convex lens.

Can you name any other objects in the real world that uses a lens?

Brainstorm in your notebooks.

Uses of Lenses

Things can look bigger or smaller if you look at them through a lens. So, lenses have many uses.



- One use is in eyeglasses and contact lenses. These lenses help people see more clearly.
- People who are farsighted have trouble seeing things that are close to them. They need eyewear with convex lenses.
- People who are nearsighted cannot see faraway objects clearly. They use eyewear with concave lenses.
- Both kinds of lenses change the path of light to a part of the eye.

Did you know? Bifocals have lenses that combine two shapes. They are used to help people with more complicated vision problems.

Lenses are also used to make **scientific tools**. So are mirrors.



- Recall that a **hand lens** is a tool used to make small things look larger.
- It is **convex lens** with a handle.
- You might use a hand lens to see details of a leaf or an insect.

Microscopes

A microscope is a tool that makes tiny objects look much larger.



- You can use a microscope to see very tiny things, such as cells of living things.
- The kind of microscope that you use in school has both convex and concave lenses.
- It may also have a mirror

Binoculars

Binoculars are a tool that makes faraway objects look closer.

- They contain two convex lenses, one for each eye.
- They may also include concave lenses.
- You could use binoculars to see a bird in a tree or mountains in the distance.



Telescopes

A telescope makes objects that are very far away look many times closer.

- You could use a telescope to see details of our moon or of other planets.
- Some telescopes contain two convex lenses.
- Other telescopes include mirrors as well as a convex lens.



How lenses work in real world objects

Click here for [video](#)