Objective:

- Understand the basic mechanism of human vision: light is focused onto the retina which creates a signal sent to the brain via the optic nerve
- Learn the ways in which our eyes change to take in different stimuli
    - Changes in iris adjust light level
    - Changes in lens shape adjust focus
- Understand the implications of stereoscopic vision
    - Elimination of blindspot
    - Depth perception

Discussion:

- Ask a few introductory questions to get the students talking:
    - What does your eye do?
    - Do you know any specific parts of the eye?
- Point out and explain most basic components of the eye on the diagram
    - The lens focuses the light onto the retina
    - The retina contains cells that turn that light into a signal
    - The optic nerve carries that signal to the brain for interpretation
- Point out the other components which respond involuntarily to different visual stimuli
    - The iris contracts and expands to control the light level at the retina
    - The cilliary body reshapes your lens to focus on objects at different distances

Experiment 1: Test your pupillary reflex

1. Ask students about their experience moving from bright outdoor light into low indoor light or the reverse. Ask what they think is happening when their eyes adjust to separate light levels.
2. (This may be done with partners or looking at yourself in a mirror) Close one eye and block all light from the front of your lid with your hand. Hold this for 1 minute. Open your eyes and observe the change to the size of your pupil.
3. Reverse the process by shining a *dimmed* flashlight *near* your eye. DO NOT SHINE THE LIGHT DIRECTLY IN YOUR EYE.
4. Observe/ask how quickly the iris can open and close. Students may notice that dilation takes much longer than contraction. Students may also notice that contraction often overshoots the final size.

Experiment 2: Model the focusing action of the ciliary body

1. Begin by having the students intentionally defocus their vision. Ask them what they think is happening.
2. Discuss the action of a lens. *Point out that different lens shapes have different effects on incoming light rays (there are two different examples on the worksheet*). Help the students follow the prompts on the worksheet. *You may want to hint that near objects need to have the light bent more steeply in order to focus onto the same spot of the retina and so will require a stronger lens.*

3. Tell the students that they are going to be looking at a simulated lens made of gelatin. The gelatin is fragile and needs to be handled gently.
4. Have the students form a circle with their thumb and pointer finger and rest the lens on top.
5. Place a piece of white paper on the desk.
6. Move the lens up and down until the image of the light fixtures is reduced to its smallest size.
7. Now gently squeeze or stretch the lens and observe the changes to the focus. While squeezing, can you bring the image back into focus by moving your lens closer to the paper?

Experiment 3: Find your blind spot

1. Refer to the handout. *Point out the location of the optical disc, the place where the optic nerve connects to the retina. At that location, there are no photoreceptors (no rods or cones). Light focused onto that point cannot be perceived. This is also called the blind spot. Each eye has a blind spot in a specific location which can easily be identified.*
2. Close your right eye.
3. Each worksheet has a blind spot tester made up of a dot on the left and a plus sign on the right. Hold the worksheet at arms length while concentrating on the plus sign.
4. Slowly bring the worksheet closer to your face while always concentrating on the plus sign. When the dot disappears, it is at the location of your blind spot.
5. Optionally, flip the paper upside down and repeat with your left eye.
6. Ask: Do you ever have a problem with seeing things in your blindspot? Why not? *Our brain fills in missing information if it is available from our other eye. If the other eye is closed, it will just make up information that makes the most sense.*
7. Now we will show how your brain will fill in your blind spot. Flip to the second page of the worksheet, there is an orange dot to the right of a broken blue bar.
8. Close your right eye and hold the worksheet at arms length.
9. Slowly bring the sheet towards your face while staring at the orange dot. When the break in the blue bar reaches your blind spot, the bar will appear solid.

Experiment 4: Test your dominant eye

1. Refer to the image on the worksheet with the bowling pins. *Both eyes work together to enhance our depth perception. However, for most people, one eye generally does a lot more of the work. You can test your dominant eye in a few ways.*
2. Select an object on the other side of the room.
3. With both eyes open, extend one index finger to point directly at the object.
4. Close one eye. Your finger should appear to shift relative to the object.
5. Open that eye and close the other. Your finger should appear shifted again. Whichever eye shifts the object the least is dominant.
6. Compare your dominant eye with others. Is it the same as your dominant hand?

Extra credit challenge

7. Stand the red and blue colored folder on the desk in front of you (red on left).

8. Using one or both hands, make a circle by joining thumb to fingers and hold it up to the center of your face.
9. Close your left eye and look straight through the circle with your right. Center the red side of the envelope in your circle.
10. Close your right eye and open your left. Is the blue side of the envelope centered on the blue side? *Probably not, depending on the relative strength of your eyes.* Can you move your hands such that the left eye sees the red and right eye sees the blue? You may have to move your head closer or farther from the envelope to accomplish this. *Note that the object you are looking at appears flat through either eye but is three dimensional with both eyes open.*

Experiment 5: Test your ability to perceive depth

1. Setup: Place the plastic cup in front of yourself about one half arms reach away. Have the student sit directly in front of you. Tip: place a few spare pennies in the bottom of the cup to stabilize it.
2. Explain the object of the game: *I will move the penny slowly back and forth. When you say "drop" I will release the penny. You want the penny to fall into the cup.*
3. Have the students try this game with both eyes open. It should be fairly easy.
4. Repeat with either eye closed. It should be more difficult.
5. Ask: *Which game is easier and why?*

Assessment Questions:

1. Can you name three parts of the human eye?
2. What is the purpose of _____ (whichever parts they chose)?