

Science – 20/20 Vision Activity

Introduction:

(5 minutes)

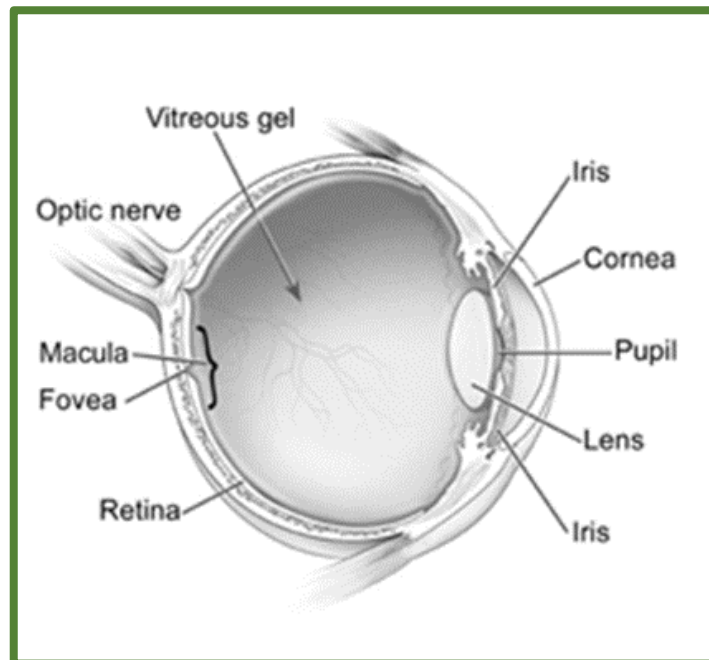
There are many science disciplines, for example, life science (the study of plants, animals, and the human body) and physical science (how things work, move, and function). Today, we are going to focus on life science, specifically Optometry or Ophthalmology. Both study the eyes and the interaction between the brain and eyes. An optometrist is an eye doctor who has earned the Doctor of Optometry (OD) degree. Optometrists examine eyes for both vision and health problems, and correct [refractive errors](#) by prescribing [eyeglasses](#) and [contact lenses](#). Ophthalmologists can perform the same functions as optometrists but can also treat more complicated eye issues and perform eye surgery. Ophthalmologists have a Doctor of Medicine (MD) degree.

Our eyes are an important part of our nervous system. What do we do with our eyes? We see the world around us! Why do we have two eyes? Well, two eyes help us see a larger area than just one eye. Each of our eyes sees an object from slightly different angles, enabling our brains to fit two images together to make 3-D images in our heads. These 3-D images help us judge distance. Does everybody see the same? Well, everyone's eyes have lenses that change shape when we focus on something. The lenses become rounder when we look at something close up and flatter when we look at something that is far away. However, not all eyes focus light rays exactly the same. How your eyes see something is called **vision**.

What does it mean to have 20/20 vision? Do you know? Listen to student ideas. Having 20/20 vision means that when you stand 20 feet away from the classroom board, you can see what the "average" person sees. If you have 20/40 vision, it means that you can only read the letters that someone with 20/20 or "normal" vision can read standing 40 feet away. This means that you must be closer to the chalkboard to read it. Can you guess what having 20/100 vision means? It means that if you were standing 20 feet from the board you would see what an average person standing 100 feet away would see. You can also have vision that is better than average. If you had 20/10 vision, you would be able to stand 20 feet from the classroom board and see what an average person sees when they are 10 feet away from the chart. A hawk's vision is eight times better than a human's—that would be almost 20/2 vision!

Introduction (continued):

The eye itself is a ball made up of three layers. The outside layer is made of two parts, the **clear cornea** (directly at the front of the eye) and the **white sclera** (gives the eyeball its shape). Beneath the outside layer is the middle layer, called the **iris**. The iris controls how much light enters the eye. It dilates to let more light in through the **pupil** and contracts to let in less light. The iris is pigmented and gives the eye its color. After light has passed through the cornea and iris, it is focused by the lens and continues to the **retina**, where the light becomes an image that is sent to the brain via the **optical nerve**.



In an attempt to see at 20/20, some people use glasses or contact lenses. Also, some amazing medical technologies have been developed with the partnership between engineers and optometrist to correct vision. One example is LASIK surgery. LASIK stands for "laser-assisted in situ keratomileusis" and is a procedure that permanently changes the shape of the cornea (the clear part on the front of the eye) by using a laser. The top surface of the cornea is cut and rolled back, revealing the middle section of the cornea. The laser vaporizes a portion of the middle section to reshape it, and then the flap is returned to its normal location over the eye. The result is an eye with a shape closer to the eye shape of a person with 20/20 vision, and thus, improved eyesight!

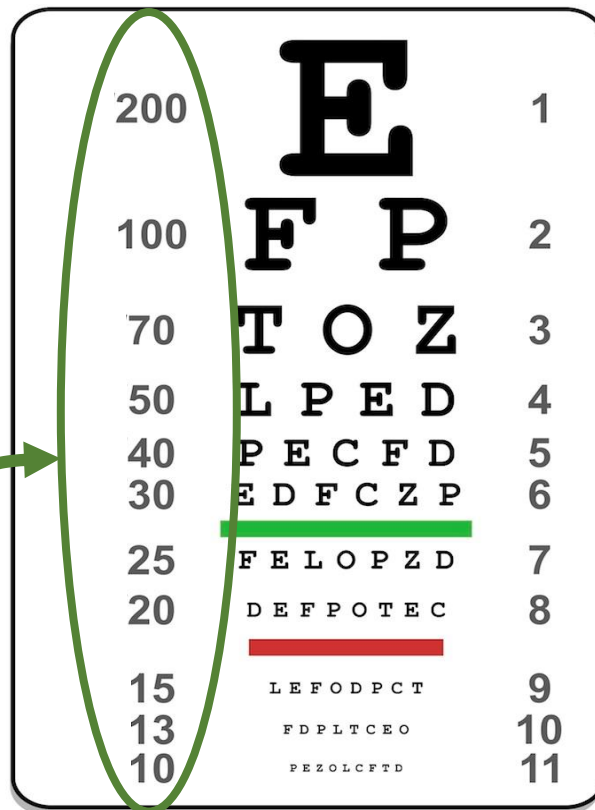
Today, we are going to measure our own vision.

Instructions: 20/20 Vision Activity

Materials:

- Eye Charts – refer to the **Instructions for Printing an Eye Chart** so that it is sized correctly
- Tape Measure
- Masking Tape
- Worksheets (1/student)

Denominator →



Instructions:

1. Affix Eye Chart it to a classroom wall. Use a piece of tape to mark a spot on the floor that is 20 feet from the chart.
2. Pass out the worksheets to each student (next page).
3. Have the students take turns standing at the 20-foot mark and identifying the smallest row on the eye chart that they can read with their right eyes (cover up the left eyes), then the left eyes (cover up the right eyes), then with both eyes together. The number to the left of the row represents the **denominator** of the fraction. For example, if the last readable row has a 30 next to it, their vision is 20/30. Note: If someone has glasses, they can try this experiment with their glasses both on and off. Remind students to record on their worksheets their vision ratings.
4. Once each student has measurements for both eyes, have them find the average of the two eyes together, recording this on their worksheet.
5. Also have students compare their average vision to the vision of both individual eyes. The results may or may not be the same.

Name: _____ Date: _____

20/20 Worksheet

- 1) The vision in my left eye is : 20/_____(row number)
- 2) The vision in your right eye is : 20/_____ (row number)
- 3) The vision with both eyes: 20/_____(row number)
- 4) Adding my answer from step 1 with my answer from steps 2 gives me:
_____ + _____ = _____
- 5) Dividing the answer in step 4 by two gives me: _____ \div 2 = _____
This is my average eyesight for both eyes. 20/_____
- 6) Is there a difference between your answers in step 5 and steps 1 and 2?
Is there a difference between your answers in step 5 and step 3? Why or why not? _____

- 7) Record the average eyesight for everyone in the class in the chart below:

Person	Both Eyes
<u>1</u>	20/
<u>2</u>	20/
<u>3</u>	20/
<u>4</u>	20/
<u>5</u>	20/

- 7) Using the vision data for the class, what is the average or "normal" vision?

Instructions for Printing an Eye Chart

20/20 Vision Activity – Eye Chart

Using a Snellen Eye Chart

The chart is usually read while standing at a distance of 20 feet. Acuity is represented as a fraction, with the distance at which you are standing being the numerator (top part of fraction), and the normal maximum legible viewing distance ("Distance" on the chart below) as the denominator (bottom of fraction). So if, at 20 feet, you can read the letters on the row marked "40," this means you have visual acuity of 20/40 or better: 1/2 normal. From 10 feet, if the smallest letters you could read were on the "40" line, this would give you an acuity of 10/40: 1/4 normal. If you are nearsighted, your vision will become more normal the closer you stand to the chart.

Make your own eye chart!

For those enterprising souls out there who would like to laser print or draw by hand their own eye chart, or if you would like to verify that your printout is of the correct proportions, here are the specs:

Distance (feet)	70	60	50	40	30	20	15	10	7	4
letter ht (mm)	31	27	22	18	13	9	7	4	3	2
letter ht (pt)	88	76	63	50	38	25	19	13	9	5
font size (pt)	152	130	108	87	65	43	33	21	15	9

Interpreting the chart

"Distance" in the above table refers to the furthest distance from the chart at which a normal eye is able to read the letter. On a Snellen eye chart, row's letters of a given size have the corresponding distance number next to them. Thus, row of 18mm letters is marked "40." The font must be Courier (or Courier Bold) in order for the "font size" in points to correspond to the indicated letter height. Courier Bold is the PostScript font that most closely approximates the official Snellen letters.

Note: the top of the second page of the eye chart will need to be taped to the bottom of the first page of the eye chart (at the dotted line). Be sure to cover the dotted line with your paper.

Source: International Society for the Enhancement of Eyesight, January 28, 2005, <http://www.i-see.org/>, accessed May 30, 2006.

A B

70

G H S

60

O Q I J

50

T R V M X

40

R D E F I L

30

Tape here ↑

20 R X J B T I F P A

15 I R G H J D S E U O Q X

10 H N M K L D R T Y E W I O Q P R E

7 F D R T K S W Q I V D H K I U T X S B K D F E

4 B O F C P T E B L F B E Z C O P E