



Physiology of Vision

By

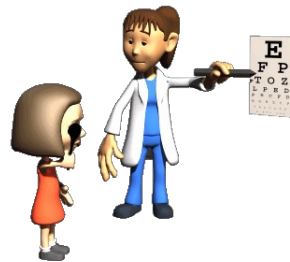
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2024 / 2025

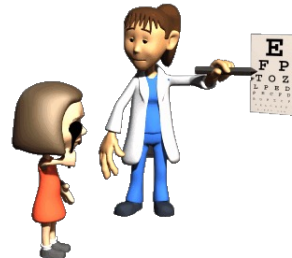
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Contents:

- **Acuity of vision (visual acuity).**
- **Color vision.**
- **Visual reflexes:**
 - Pupillary light reflex.
 - Consensual light reflex.
 - Accommodation reflex.



Acuity of vision (visual acuity) test:

- It is a type of **eye examination** that measures the eyes' ability to see details at a specific distance (**6 meters or 20 feet**).
- It is a noninvasive test and don't involve any risks or special preparation.
- The visual acuity of each eye is determined separately.
- Emmetropia:** the eyes can see an object of a specific size clearly at 6 M or 20 feet.
- Ametropia:** is an abnormal refractive eye condition in which images fail to focus upon the retina.



Ametropia:

- a group of visual disorders caused by errors in the refractive power of the eye (refractive errors).
- The eyes are **unable to refract light correctly**. It includes:
 - Myopia** (nearsightedness): Myopic eyes has:
 - ✓ blurry distance vision and clear near vision.
 - Hyperopia** (farsightedness): Hyperopic people can see:
 - ✓ distant objects clearly, whereas nearby objects appear blurry.
 - Presbyopia** (age-related farsightedness):
 - Astigmatism** (irregularly shaped cornea):
 - ✓ Occurs when the cornea or the eye lens has an abnormal shape, making light bend incorrectly when entering the eye.

Visual acuity:

$6m_{\text{Examined}} / 6m_{\text{Normal}}$ (=1 is normal) (m= meter)

$20f_{\text{Examined}} / 20f_{\text{Normal}}$ (=1 is normal) (f= feet)

$6 / 6$ ($20/20$)= 1 normal vision (=1 is normal)

$6 / 4$ ($20/13$)= 1.5 (>1 is super vision)

$6 / 18$ ($20/60$)= 0.33 abnormal (<1 is abnormal)

$6 / 9$ ($20/30$)= 0.66 abnormal (<1 is abnormal)

Visual acuity:

$6m_{\text{Examined}} / 6m_{\text{Normal}}$ (=1 is normal)

$20f_{\text{Examined}} / 20f_{\text{Normal}}$ (=1 is normal)

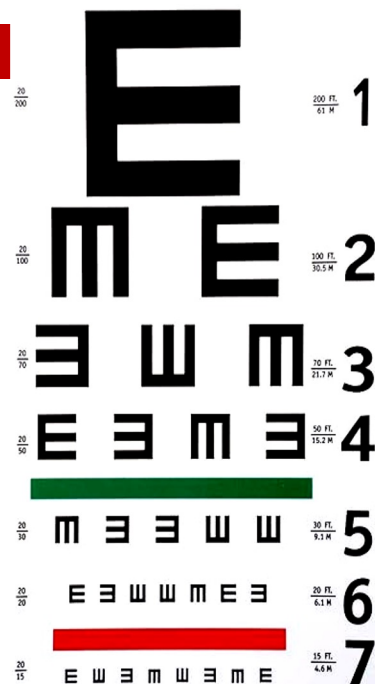
(m= meter) and (f= feet)

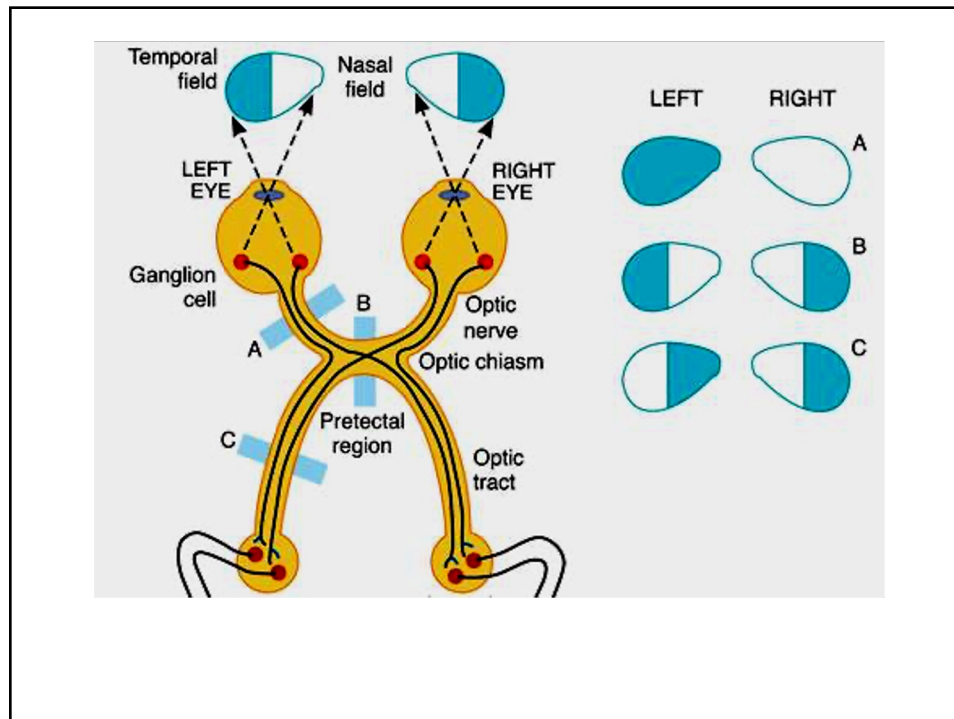
$6 / 6$ ($20/20$)= 1 (=1 normal vision)

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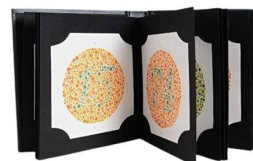
$6 / 9$ ($20/30$)= 0.66 abnormal (<1)





Color Vision:

- The Cones are responsible for perception of Color.
- The Rods are for the perception of intensity of light.
- Color vision is tested by **Ishihara's charts**.
- The charts consist of numerals constituted by dots of different colors.
- A normal person can read the numerals, whereas a color blind cannot.
- The subject (examined person) should be asked to read each plate from a distance of 75cm, within 30sec.

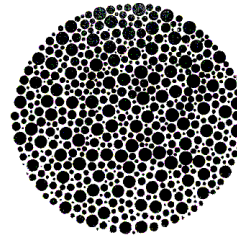


Color Vision:

- Abnormalities of color vision known as **color-blindness**.
- **Color-blindness** is common in men ~8% but much less common in women ~0.4%.
- The common abnormalities are inherited as **X-linked recessive characters** and result from absence of appropriate color genes in the **X-chromosome**.

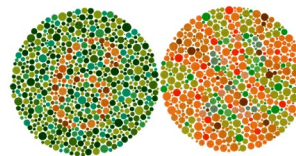
8%_{men} : 0.4%_{women}

20_{men} : 1_{women}

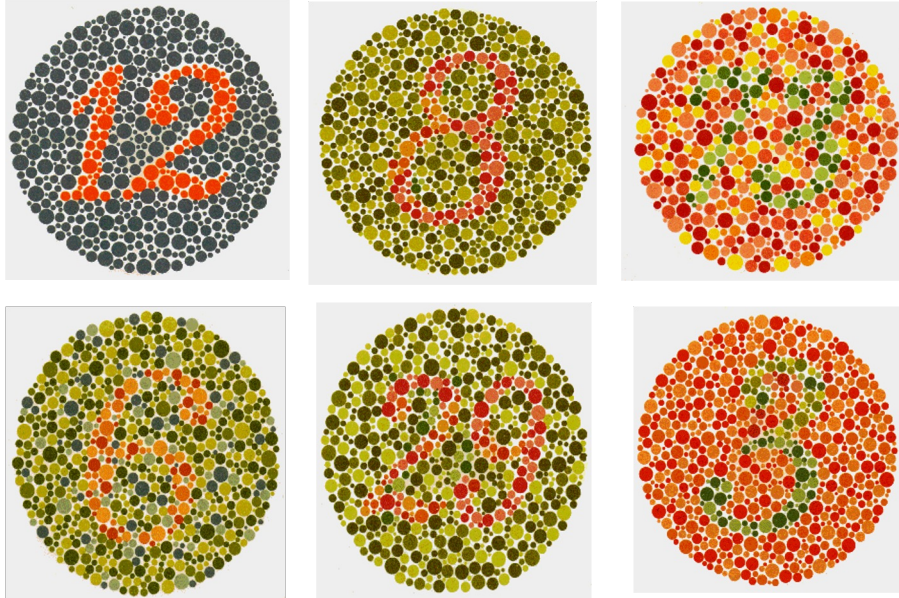


Color Vision:

- 2% of all men are red color blind (**protanomaly**).
- 6% are green color blind (**deuteranomaly**).
- Blindness to blue color (**tritanomaly**) is very rare.
- Ishihara's charts are used to test color vision.



What numbers do you see revealed in the patterns of dots below?

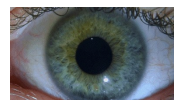


Visual Reflexes:

▪ Pupillary (direct) light reflex:

Procedure:

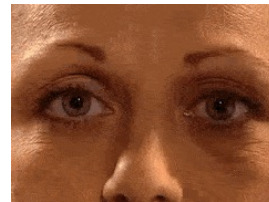
- Throw torch light into an eye and observe constriction of pupil in the same eye.



Consensual light (Indirect) reflexes:

Procedure:

- Keep one hand between the 2 eyes of the subject, and throw torch light into one eye and observe constriction of the pupil in the other eye.
- The consensual light reflex is due to **decussation** of the **optic nerve fibers in the optic chiasma** so that the impulses reach oculomotor nuclei of the two sides.



Accommodation reflex:

- This is the ability of the eye to focus on objects at varying distances.

How to do the test:

- Hold one finger at a distance of 25cm from the subject. Ask him to first look at a distant object and then look at the finger.

Accommodation reflex:

Accommodation consists of three associated events:

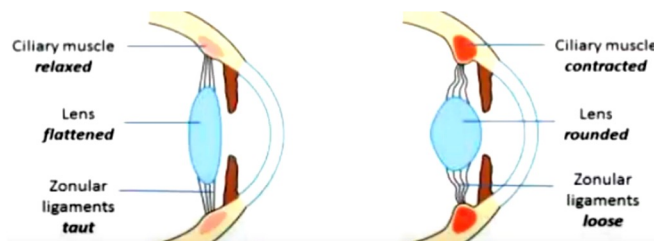
1. Eyes converge toward the near object.
2. Pupils constrict.
3. The optical power of the lens is increased.



Accommodation reflex:

The mechanism of increased optical power of the lens includes:

- ① The **ciliary muscles** on both sides **contract**.
- ② The **suspensory (zonular) ligament** of the lens is **relaxed (loose)**.
- ③ The **anterior surface of the lens** becomes **more convex**, which **increases its focusing power**.



Questions/Comments

