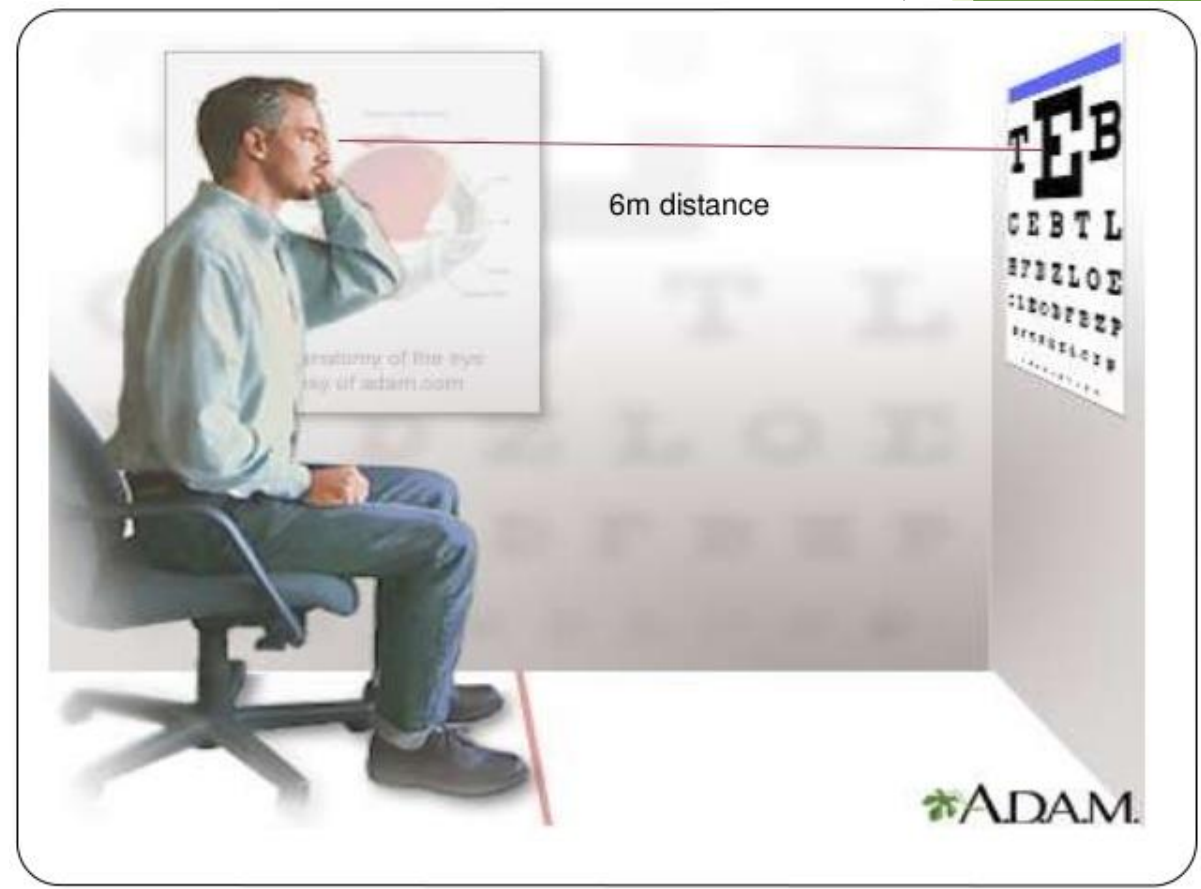




VISUAL ACUITY AND COLOR VISION

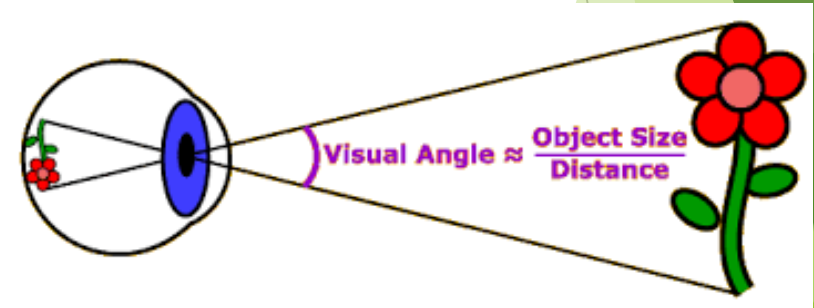
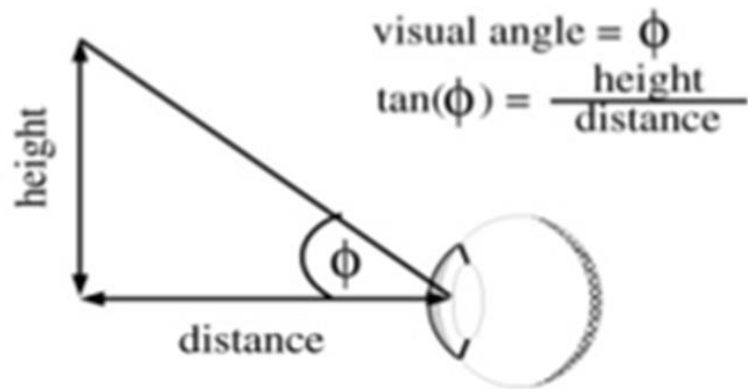
VISUAL ACUITY

- ▶ Resolving power of the eye or
- ▶ The ability to see two objects as separate
- ▶ It can be expressed in terms of visual angle



VISUAL ANGLE

- The angle subtended at the nodal point of the eye by the physical dimensions of an object in the visual field.



PRINCIPLE OF VISUAL ACUITY

- ▶ We can resolve **two points** or **parallel lines** and recognize them as **two only**, when visual angle is of **1 minute of arc**
- ▶ Letters used to find visual acuity are made in such a way that when they are read from the distance specified in the chart, **each letter subtends an angle of 5 minute** and each part of the letter **1 minute of arc**

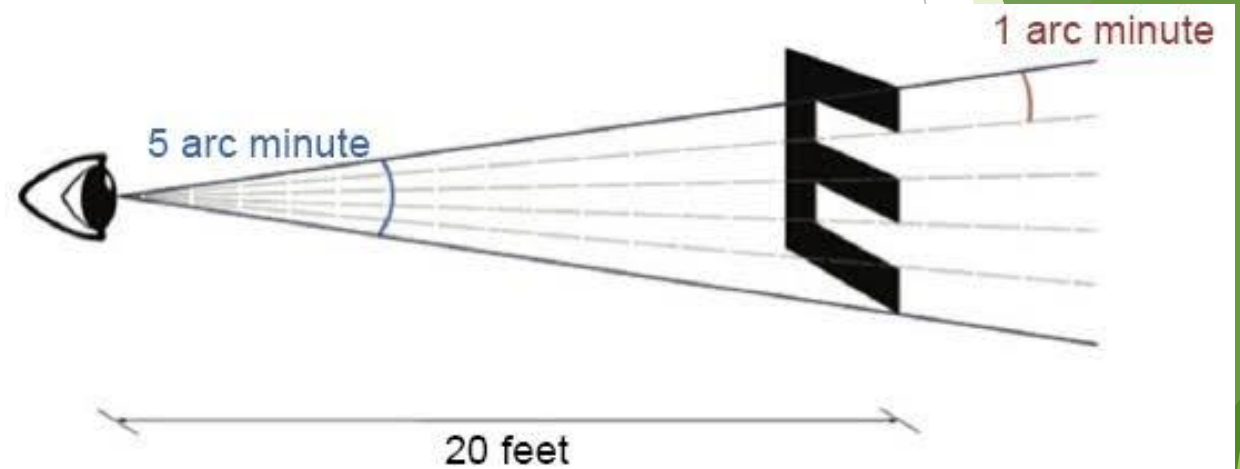


Figure 2 Illustration of a typical block letter E where each of five vertical segments subtends 1 minute of arc (totaling 5).

Note: Note that the angles are not drawn to scale.

DISTANT VISION

- This is tested with the help of **Snellen's chart** by the ability of subject to recognize test letters illuminated suitably.
 1. Subject is asked to stand at a **6 meter/20 feet** distance from the chart.
 2. He is asked to read the letters with one eye after covering the other eye with eye occluder.
 3. Note down which line he is able to read.
 4. Repeat the same procedure with other eye after covering the first one.
 5. Snellen's chart is so designed that a normal individual should read the letters in the smallest (7th) line at 6 meter or 20 feet distance.

Visual acuity = d/D

d=Distance between chart and subject (**Distance at which the patient can read the letters**)

D=Distance at which he is supposed to read the particular line

- If he is not able to read even the top line marked 60, ask him to come 1 meter closer to the chart.
- If he is not able to read it then sequentially shift him to 4 m, then 3 m, 2 m and finally to 1 m.
- If he is not able to see the top letter even at 1/2 m then **finger counting** is done at an arm's length.
- If he cannot count the fingers then do **hand movements**.
- If hand movements are also not perceived then **perception of light** is checked with the help of torch light.
- Repeat the same procedure for other eye and record your observation.
- First check without glasses and then with glasses.
- Second chart used for this purpose is known as illiterate (E) chart.

NEAR VISION

- This is a test to check **accommodation power of the eye**
- The following charts are used to assess the visual acuity for near vision
 1. **Jaeger's or J chart**
 2. Snellen's near vision chart

NEAR VISION

- Ask the subject to read Jagger's chart after holding it at a distance of **30-45 cm**.
- Bring the eye occluder before the non testing eye.
- Ask the subject to read chart from top to lowest line.
- **Smallest letter in the chart is N6.**
- Individuals with normal acuity are able to read letters of N series.
- Record the **near visual acuity** as the **smallest type of letter** which the subject can read comfortably.
- **The visual acuity of a normal subject is N6.**
- Repeat the same procedure for the other eye.

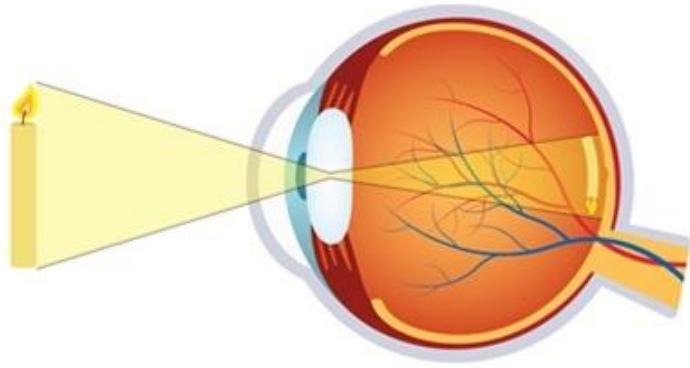
FACTORS AFFECTING VISUAL ACUITY

- Illumination of test object
- Contrast of letters
- Cognitive ability
- Ocular health
- Refractive status

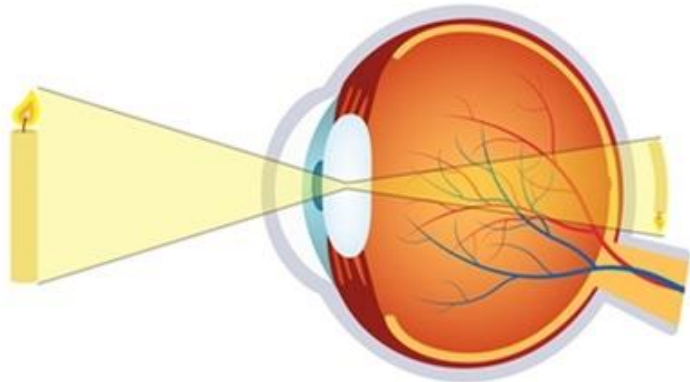
Refractive Errors:

- ▶ Common cause of impaired vision, correctable with glasses.
- ▶ **Hyperopia:** Also known as “farsightedness.”
- ▶ **Eye too short for refractive power of cornea and lens;**
Light is focused **behind retina.**

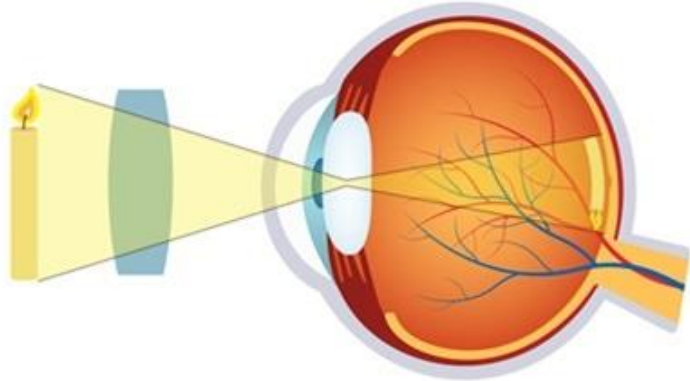
Correct with convex (converging) lenses.



Normal vision



Hyperopia



Correction
with lens

Myopia: Also known as “nearsightedness.” Eye too long for refractive power of cornea and lens \Rightarrow light focused in front of retina

MYOPIA

Myopia (Near-Sightedness)

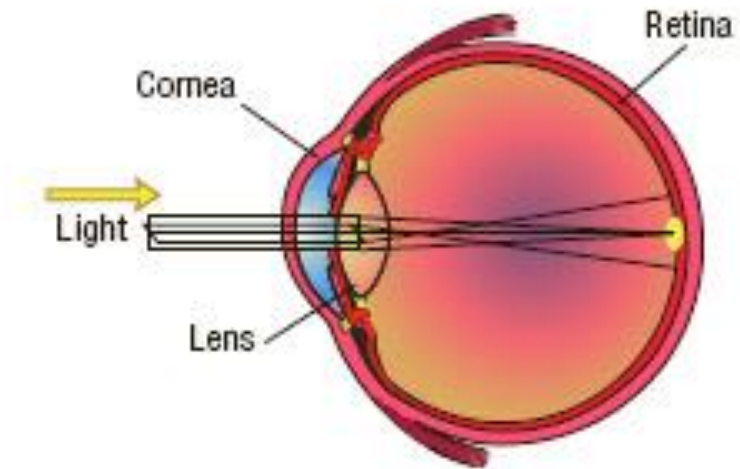
Eyeball too long or refractive power of the eye too strong.
Parallel rays of light are brought to a focus in front of the retina.

Concave lens used to correct myopia.

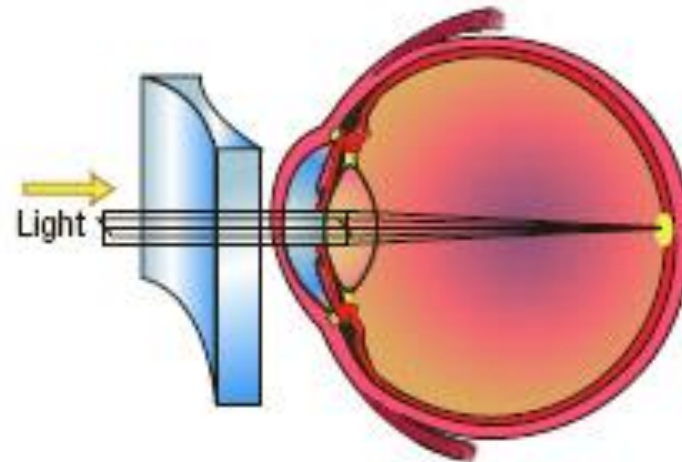


shutterstock.com • 1537226492

Astigmatism: **Abnormal curvature** of cornea → different refractive power at different axes. Correct with cylindrical lens.

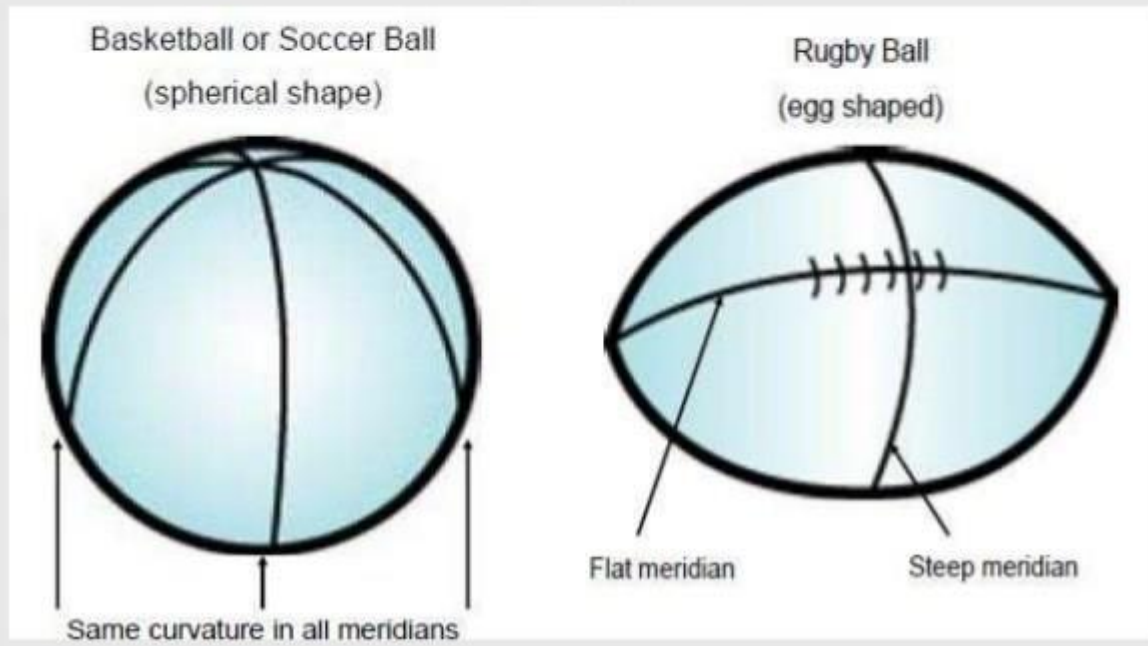


Horizontal line out of focus

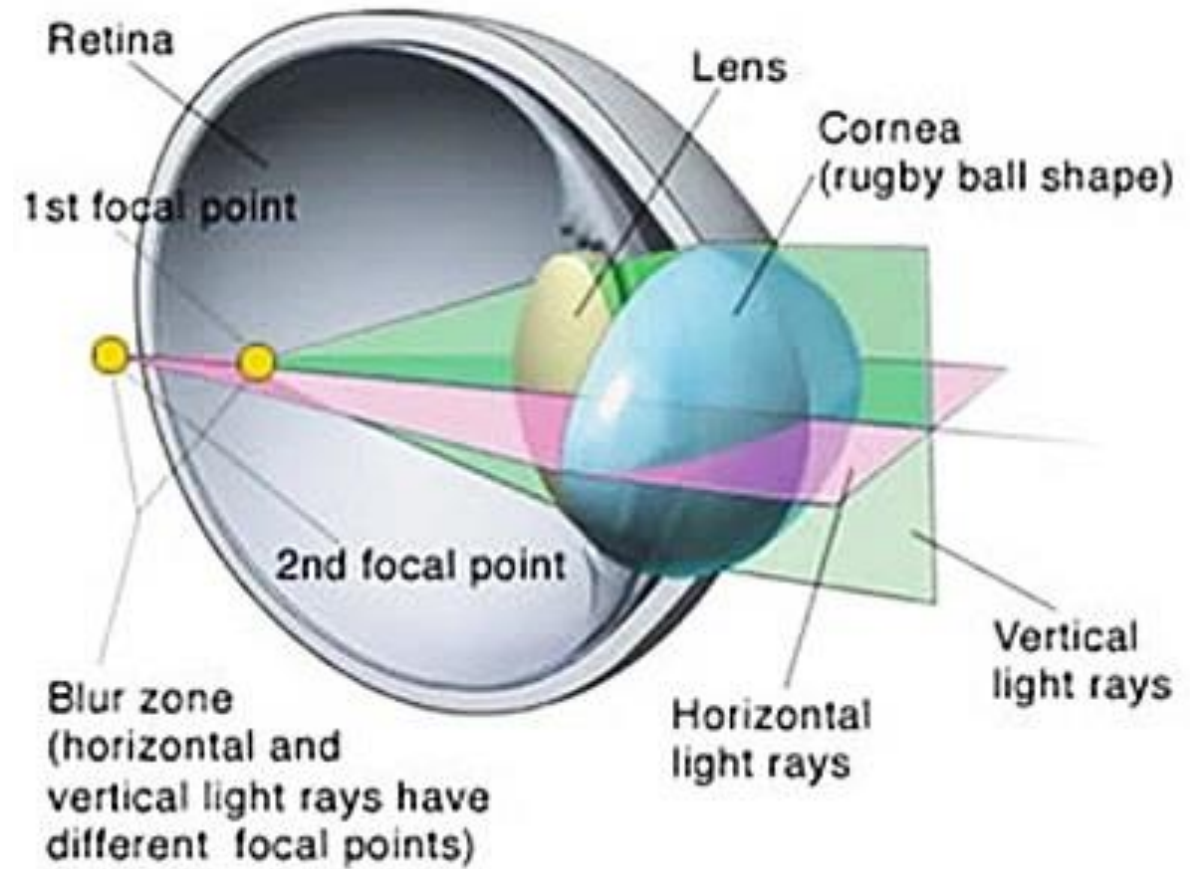


Astigmatism corrected by lens

The shape of eye ball

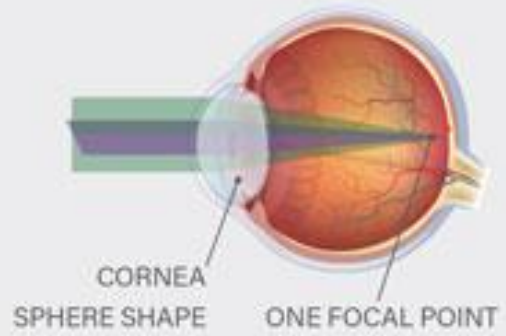


CROSS SECTION OF ASTIGMATIC EYE



NORMAL VISION

Round Cornea



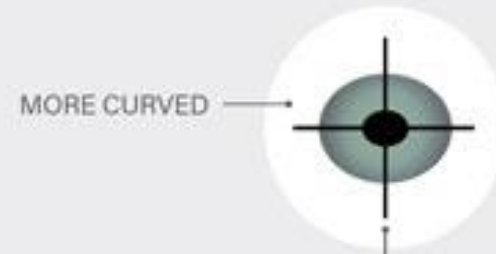
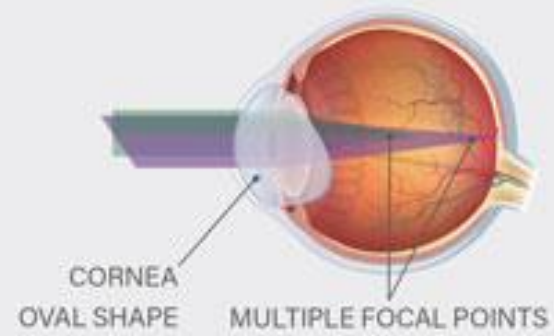
SAME CURVATURE



SOCCER BALL (ROUND)

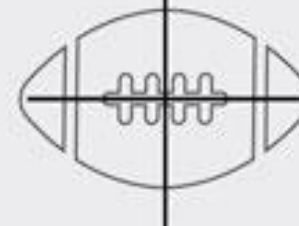
ASTIGMATISM

Football-Shaped Cornea



MORE CURVED

MORE FLAT



FOOTBALL (NOT ROUND) STEEPER

COLOR VISION

Color vision is a function of **cones (red, green and blue)**

Ability of eye to discriminate between colors excited by light of different wavelengths

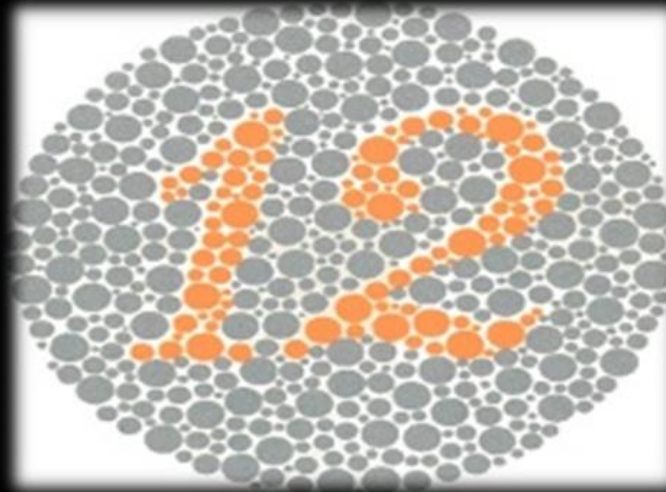
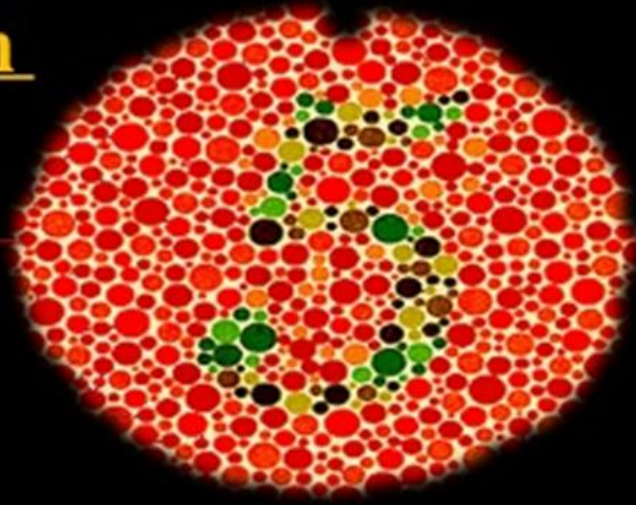


Tests For Colour Vision

Ishihara charts:

Charts containing some numbers made up of different coloured and sized dots on a similar background.

Inability to identify a number suggests some defect of colour vision.



- The distance between the **subject and chart** should be maintained at **50-80 cm**
- Color vision must be appreciated in adequate light
- Record color vision one by one, by occluding one eye with eye occluder and later on by both

Significance of Colour Vision

Pilots, Navigators, vehicle drivers and railway employees require normal colour vision as they deal with colours for running their machines.

Color Blindness

- ▶ Inability to perceive one or more different color
- ▶ Case Definitions:
- ▶ **Anamoly**: if there is weakness for one particular color
- ▶ **Anopia**: if there is complete absence of one color

CLASSIFICATION OF COLOR BLINDNESS

▶ **1. Trichromats:**

▶ All 3 types of cones are present but **one is abnormal**. Classified as:

▶ A. **protoanomaly** (red weakness)

▶ B. **deuteranomaly** (green weakness)

▶ C. **tritanomaly** (Blue weakness)

▶ **2. Dichromats:** only 2 types of cones are present. Classified as

▶ A. **protanopia** (red blindness)

▶ B. **deuteranopia** (green blindness)

▶ C. **tritanopia** (blue blindness)

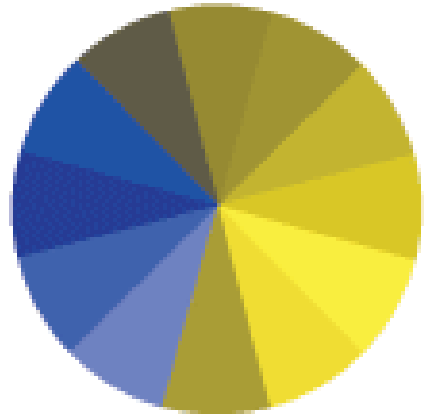
▶ **3.. Monochromats** : Only one type of cone present and **only shades of grey are appreciated**

Protanaopia	Red appears as black, and most shades of green, orange, and yellow all appear as just one shade of yellow.
Deuteranopia	Variations of red appear light brown or dark yellow, and most greens appear as beige
Tritanopia	Blue appears identical to green and yellow and red seems pink.

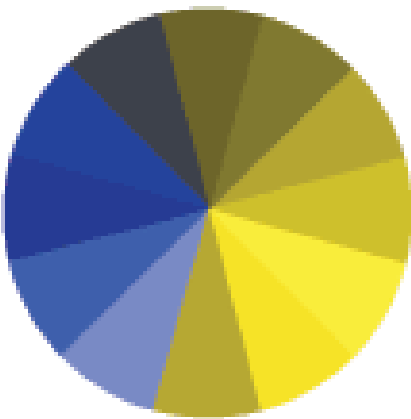
Normal vision



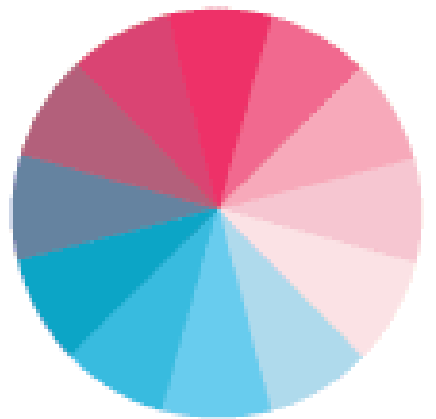
Deuteranopia



Protanopia



Tritanopia



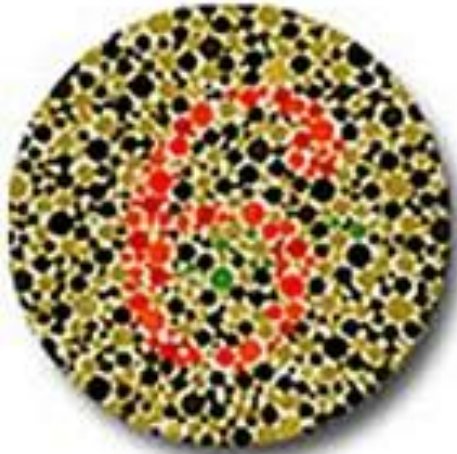


What most people see



What I see





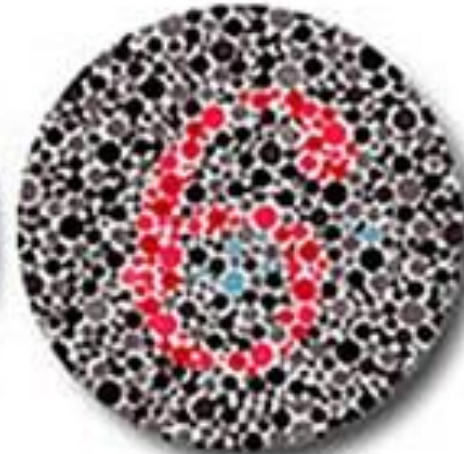
**Normal
Vision**



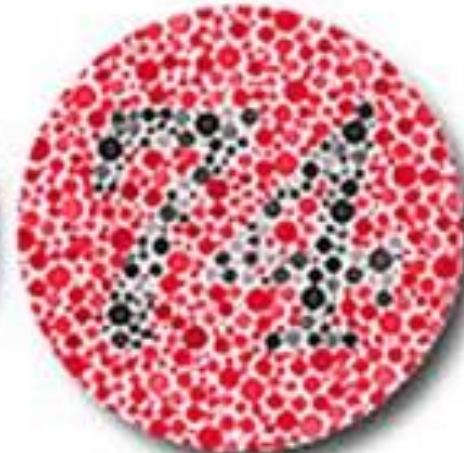
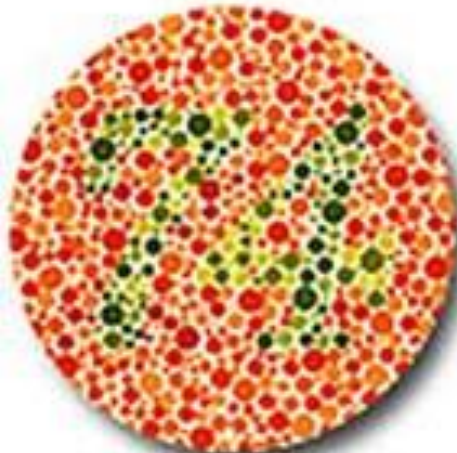
**Protanope
Vision**

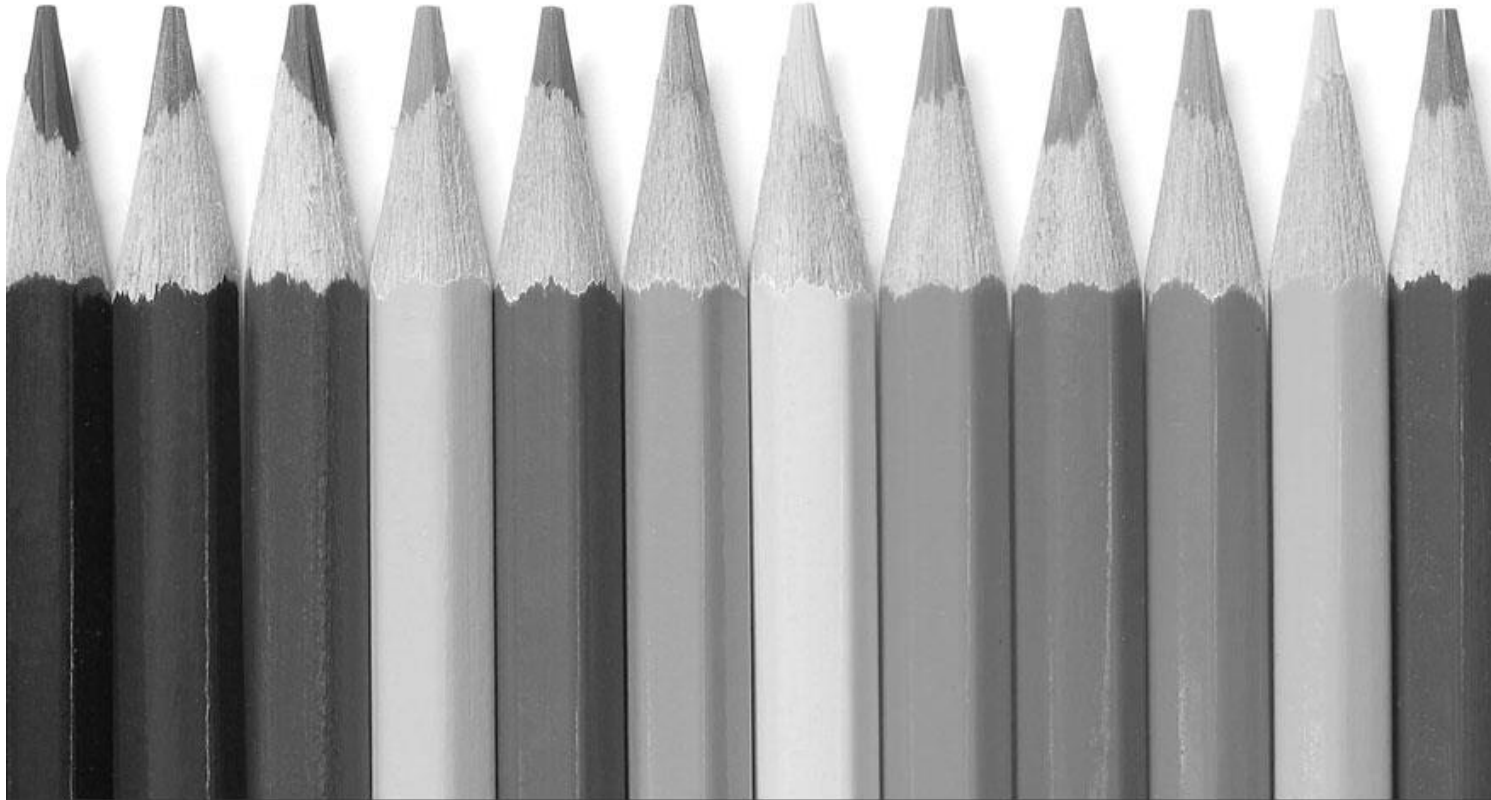


**Deuteranope
Vision**



**Tritanope
Vision**





TOTAL COLOR BLINDNESS



NORMAL VISION



DEUTERANOMALY



PROTANOPIA



TRITANOPIA



<https://midtownvision.com/blog-posts/types-color-blindness>

THE WORLDWIDE BESTSELLER

'Rattling.
Heartbreaking.
Beautiful'
ATUL GAWANDE

'Powerful
and
poignant'
SUNDAY TIMES

WHEN
WHAT MAKES LIFE WORTH
BREATH
LIVING IN THE FACE OF DEATH
BECOMES
PAUL KALANITHI
AIR



Thank you