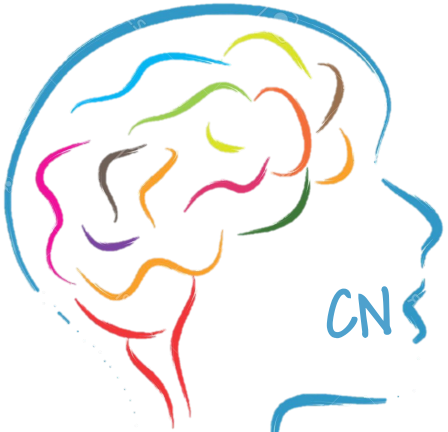
Physiology Practical Revision



Color index

- Important
- Further Explanation

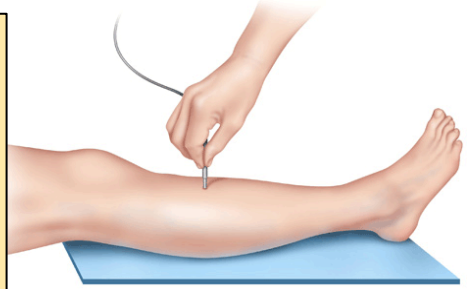
Please check out this link before viewing the file to know if there are any additions/changes or corrections. Physiology Edit

Physiology Team 434
contact us : physiology434@gmail.com

ElectroMyoGraphy (EMG)

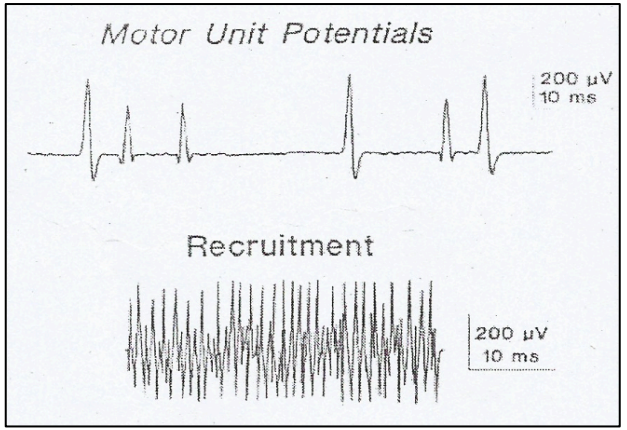
EMG is the recording of electrical activity of a skeletal muscle at rest & during contraction, inserting needle (Recording electrode) in the belly of the muscles or by applying the surface electrodes.
(to evaluate the electrophysiology of a Motor unit)

Instrument : Electromyograph
Record: Electromyogram



Motor unit (MU) is defined as one motor neuron and all of the muscle fibers it innervates.

- **Normally** a muscle is silent at rest after insertional activity has ceased.
- Then the **patient is asked to contract** the Msl smoothly.With muscle contraction, MUs are activated and **MUPs**[1] appear on the screen.
- Patient **makes progressively stronger muscle contraction results in recruited units** discharching at a faster rate and new units being recruited.



1: Motor unit potential (MUP) : represents the summation of the potentials generated by Msl fibers belonging to the MU

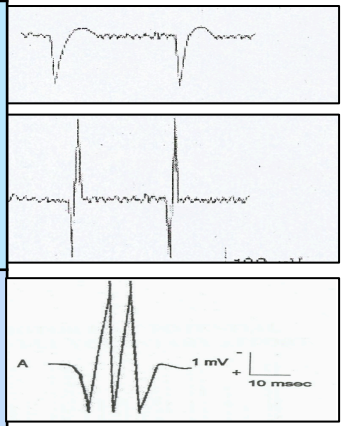
Indication for EMG

Along with motor nerve conduction study (NCS) can help in confirming a diagnosis, grave severity of disease, define evolution, stage and prognosis

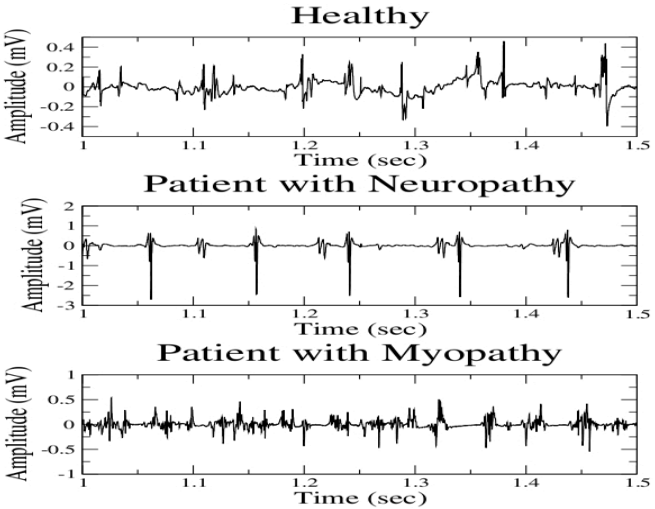
✧ **EMG Abnormalities**: -Can be seen in any part of the study-

- **Rest:**
  - ✓ Positive sharp waves
  - ✓ Fibrillation
  - ✓ Fasciculation
- **MUPs:**
  - ✓ Abnormal duration
  - ✓ Abnormal amplitude
- **Recruitment**
  - ✓ Rapid
  - ✓ Reduced

Resting Activity		
Finding	**Characteristics**	**Cusses**
Positive Sharp Waves	Fast down-stroke and slower return to baseline	•Neuropathy •Myopathy
Fibrillation	•Twitching spontaneously •Absence of innervation. •Slow & regular firing patter •Like "trick of a clock"	
Fasciculation	•Randomly discharging Action potential •Presence of innervation •Like "Large raindrops on a roof"	•Neuropathy •Motor-nueron disease •Normal in some pts



MUP	Normal	Myopathic	Neuropathic
Duration (msec)	3 – 15 msec	Shorter	Longer
Amplitude	300 – 5000 µv	Smaller	Higher
Phases	Biphasic/ triphasic	Polyphasic	Polyphasic



Study Questions -From Handouts-

- **What is meant by "the motor unit'?**

Is a motor neuron and all of the muscle fibers it innervates.

- **What is meant by "motor unit potentials (MUPs)"?**

Represents the summation of the potentials generated by Msl fibers belonging to the MU

- **What will a normal recording of a muscle show in each of the following states;**

✓ **Rest:** No activity

✓ **Mild muscle contraction:** MUPs, biphasic/triphasic, short duration.

✓ **Maximal muscle contraction:** Recruitment, ↑ number of functioning movements until the base line is obscured.

- **In a Denervated muscle. What are the characteristics findings that do you see in the EMG study?**

Fibrillation potentials, slow and regular firing patter + reduced recruitment.

- **In a Myopathic muscle. What are the characteristics findings that do you see in the EMG study?**

MUP will be short in duration, small and polyphasic + rapid recruitment.

Along with either Fibrillation, positive sharp wave and. (Depending on the picture they will put☺)

Nerve Conduction Studies

A nerve conduction study (NCS) is a test commonly used to evaluate the function of peripheral nerves , It involves study of measurement of conduction velocity and response latency[1]. Motor and sensory nerve conductions are studied separately and require different techniques .

- Most common nerves tested in upper limb are: the median, ulnar and radial nerves

✧ Calculation of Motor Nerve Conduction Velocity:

It can also be calculated by formula:

$$\text{MNCV} = \frac{\text{Distance (mm)}}{\text{L1-L2 (msec)}}$$

IF IN cm MULTIPLY BY 10 TO GET mm VALUE

(L1 = latency at elbow. L2 = latency at wrist)

Normal Values For Conduction Velocity

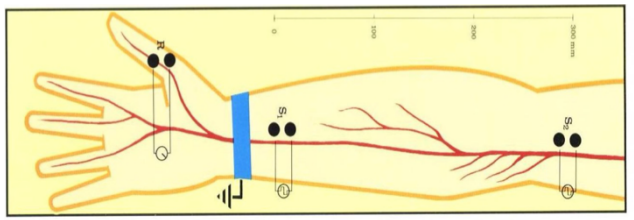
In arm 50 – 70 m / sec.
In leg 40 – 60 m / sec

MNCV less than normal value an indication of either:

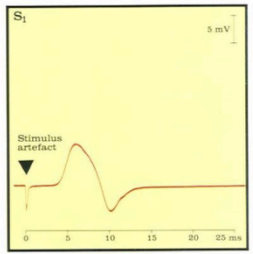
- ✓ Demyelinating diseases
- ✓ Nerve compressions
- ✓ Entrapment انحباس

$$\text{MNCV} = \frac{285 \text{ mm}}{8.5 - 3.5 \text{ msec}} = 57 \text{ m/sec normal}$$

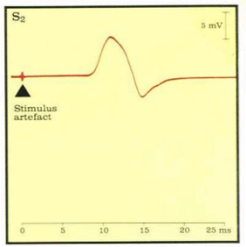
✧ Example



Distance (d= 285 mm)



Latency At wrist (L2 = 3.5 ms)



Latency At elbow (L1 = 8.5 ms)

1: The time it takes for the impulses to travel from the stimulating to the recording site, which is measured in milliseconds.

Hearing Test & Pure Tone Audiometry

✧ Terminology

○ Air conduction

This test assesses the transmission of sound waves through air to the auditory cortex via:

✓ Auditory nerve involving outer, middle and inner ears.

○ Bone conduction

This test assesses the transmission of sound waves through the bones of the skull to the cochlea and then through the auditory pathways to the auditory cortex, bypassing the outer and middle ears. (Inner ear is working only)

Air conduction is better than bone conduction in normal person

The sound is amplified 22 times when it is transmitted through air conduction by

1-The tympanic membrane (17 times)

2-The ossicles (1.3 times).

○ Masking Sound

•Masking sound is the sound present in the background that interferes with the sound that we want to listen.

Pure Tone Audiometry

Is the procedure where it measures your ability to hear sounds that reach the inner ear through the ear canal (Air conduction) or through bone (Bone conduction.

- Requirements:
  - ✓ Sound proof room.
  - ✓ Pure tone audiometer.
  - ✓ Audiograph paper.

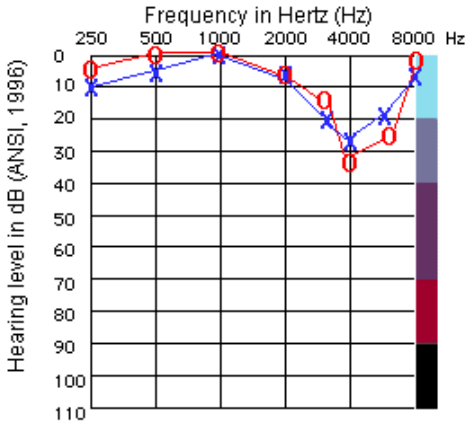
✓ Pure Tone Audiometer

Is the instrument used by audiologists to measure hearing thresholds.
Threshold = the minimum level at which a signal can be detected

✓ Audiograph Paper The graph is designed so that:

X axis: frequency (pitch) Is the number of sound waves per sec measured in Hertz
(125Hz near left and 8000Hz near Right)

Y axis: Intensity (loudness) is the level of sound power measured in decibels
(0 dB near the top and 110 dB near the bottom)



The Decibel Is The Unit Used To Express Magnitude Of Hearing Loss

The horizontal line at 0 dB hearing level (HL) represents normal hearing sensitivity for the average young adult & The amount of hearing loss: on the vertical axis.

Types Of Hearing Loss (Deafness)

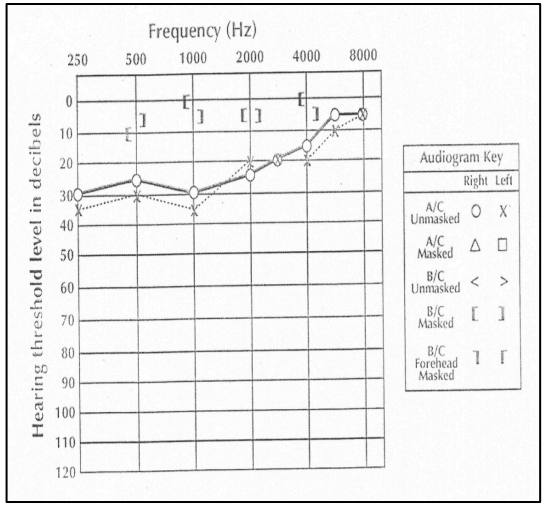
	Conductive Deafness	Sensorineural Deafness	Mixed Hearing Loss
Parts affected	Outer or middle ear	Inner ear or neural pathway	Middle or outer with inner or neural pathway
Conductions	-Air conduction is Reduced -Bone conduction is Better "due to loss of Amplification"	-Air conduction is better than bone conduction -Frequencies between them is **within 10 db** -Sound threshold must be **more than 30db** for each frequency to be heard	-Bone conduction is better than air conduction -Frequencies between them is **more than 10 db** -Sound threshold must be **more than 30 db**for each Frequency to be heard
Causes	1. Wax in ear canal 2. Rupture of tympanic membrane **3. Otitis media** **4. Otosclerosis**	**1. Meniere's disease** 2. Head trauma 3. Malformation of inner ear 4. Drugs that toxic for inner ear **5. Prebysacusis (old age)**	

Types Of Hearing Loss (Deafness) cont.

Key

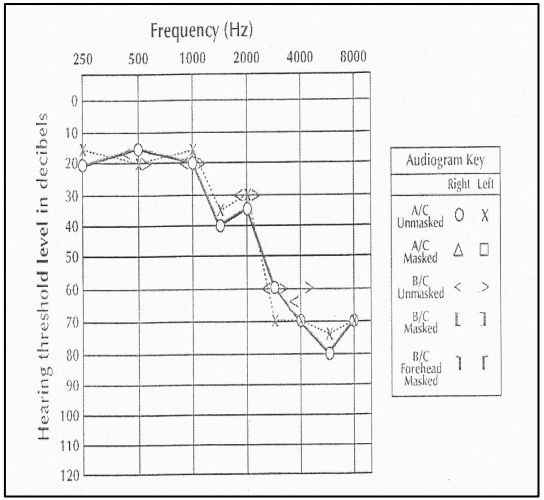
[ ] < > Bone conduction

× ○ △ □ Air conduction

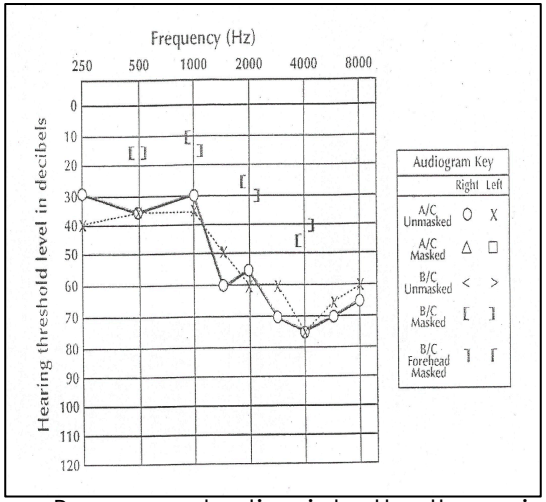


Bone conduction is better than air conduction, they are merging with each other at high f so it's

Conductive Deafness



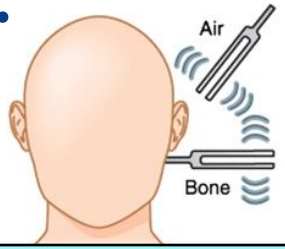
Air conduction is better than bone conduction, hearing threshold is more than 25-30db at higher f. so it's **Sensorineural Deafness**

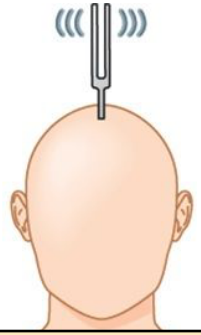


Bone conduction is better than air conduction and the dif, between them is more than 10db in all f also the hearing threshold of air conduction in most f is more than 25db so it's

Mixed Hearing Loss

Tuning Fork Tests:

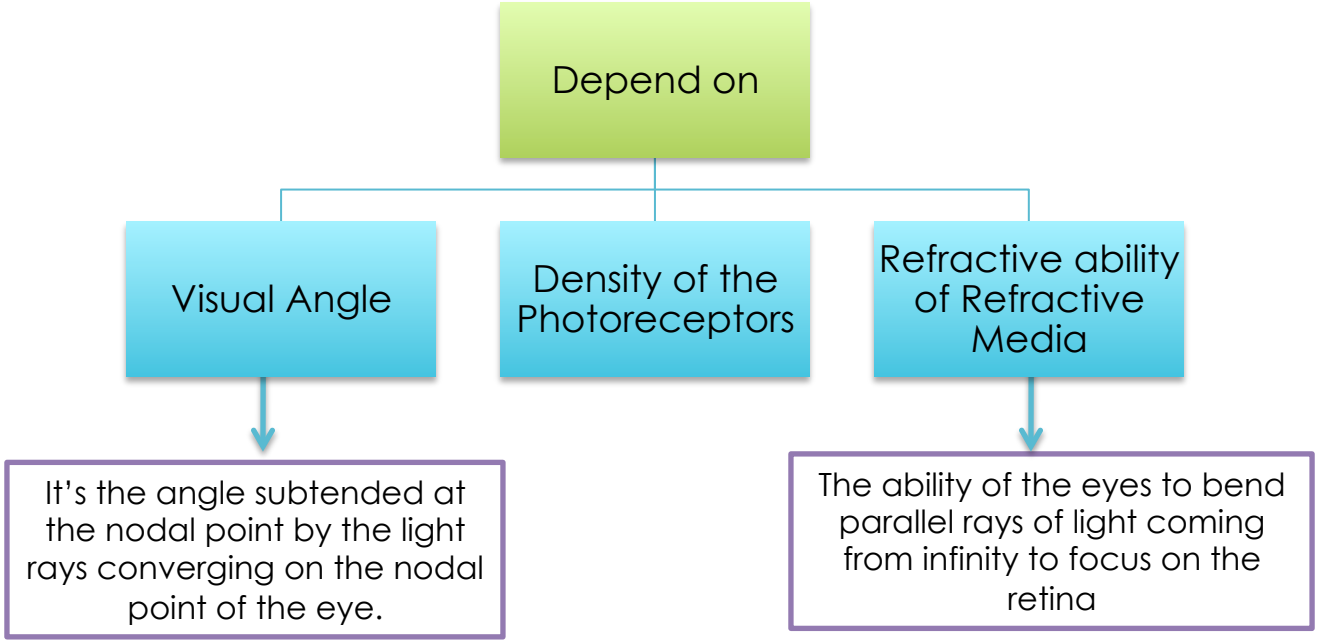




	Rinne's test	Weber's test
Used to	Compares the air conduction with the bone conduction	Distinguishes between conductive and sensorineural deafness.
Technique	Applied vibrating tunic fork in base of mastoid process then in front of the ear	Applied vibrating tunic fork in vertex of subject
Normally	Sound in air conduction twice as long as bone conduction. (They will still hear it in front of the ear when they can't hear anymore from the base of the mastoid bone)	Sound equal in both eyes
in case of Conductive Deafness	Bone conduction will be better than air conduction. (when the subject stops hearing sound from the mastoid bone and brings the tuning fork in front of the ear, he will not hear any sound there too)	Sound heard better in diseased ear due to loss of masking effect
in case of Sensorineural Deafness	Sound in air conduction is heard longer than bone conduction in affected ear. but less than twice longer as is the case in normal subjects.	Sound heard better in normal ear because cochlea and neural pathway are intact.

Visual Acuity

The power to discriminate details or the shortest distance by which 2 lines can be separated and still perceived as 2 lines.

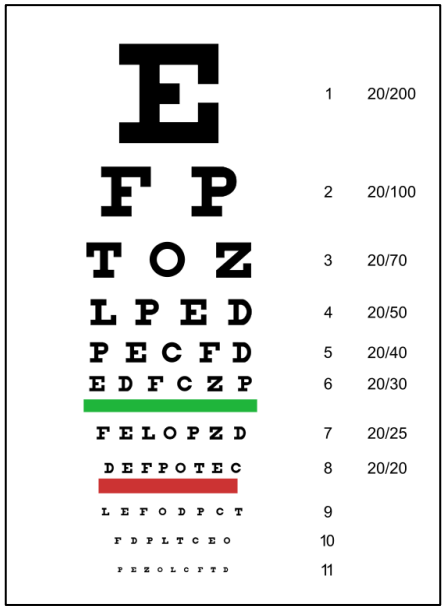


NOTE: The average person can resolve 2 points & recognise their separation when the angle they subtend is **1 minute (1/60 degree)**. The space on the retina is 4.5µm or there is at least one unstimulated receptor between the 2 lines.

Visual Acuity Test

indicative of the function of the Fovea which is used for Central Vision

1- Distant "Far" Vision Test



Equipment: Snellen's Chart Test

Interpretation:

Visual Acuity = d / D

d = distance between patient & chart

D = distance from where a normal subject can read fully

Normal Visual Acuity for far vision is 6/6 (in meters) or 20/20 (in feet)

VA : 20/20 is a reference standard.

Example:

Visual Acuity of 20/80 :The patient can recognize at 20 feet a symbol that can be recognized by a person with Normal Visual Acuity at 80 feet.

- ✓ The larger the bottom number the poorer the vision. (eg:20/30).
- ✓ The less the bottom number the better the acuity. (eg:20/15).

2- Near Vision Test

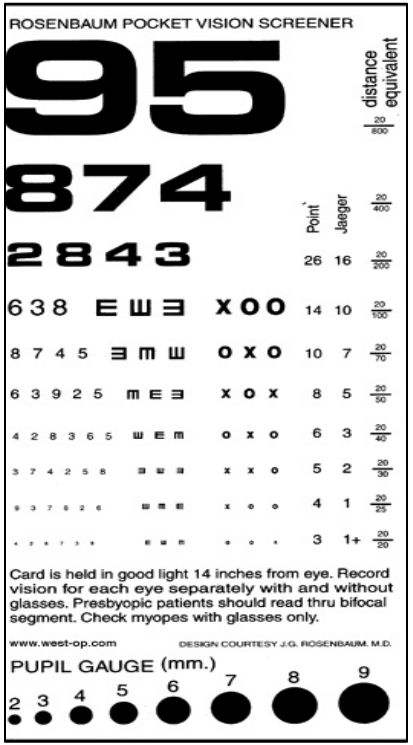
Equipment: Jaeger's Chart Test

Interpretation:

The near vision test is measuring your ability to read and see objects within an arm's distance from the body.

This test is important if you have:

1. Hypermetropia
2. Presbyopia "in old age".



✓**Myopic (nearsighted)** person will have better Visual Acuity at near than at far.

✓**Hypertropic (farsighted)** person will have better Visual Acuity at far than at near.

Astigmatism

Irregular curvature of one or more surfaces of the cornea or lens; So there is no distinct point of focus inside the eye, but rather smeared or spread out focus

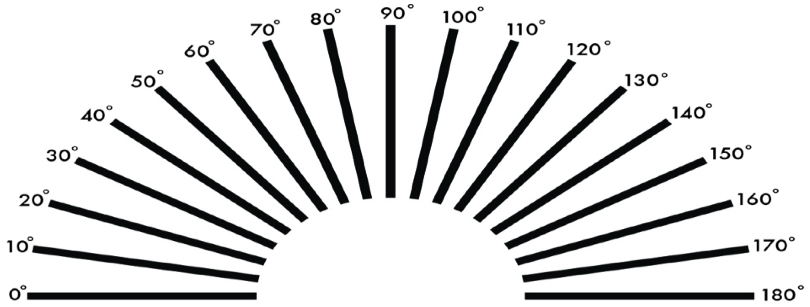
Procedure: "no need to memorize it"

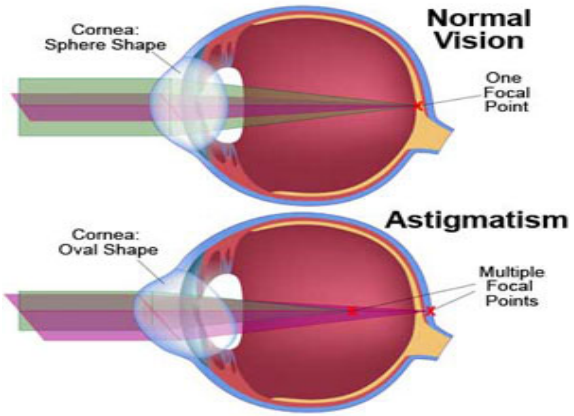
✓Subject stands at 6m (20 ft) from an astigmatism chart

✓Covers one eye.

✓This chart consists of a nbr of dark lines radiating from a central point.

✓If astigmatism is present, some of the spokes appear sharp & dark ;others appear blurred & lighter.





Equipment: **Astigmatism Chart**

Refractive Errors

	Myopia "Nearsightedness"	Hyperopia/Hypermetropia "Farsightedness"	Astigmatism
Definition	Refractive error in which close objects are seen clearly, but the far objects appear blurred	Refractive error in which close objects are seen blurred, but the far objects appear clearly	Refractive error that causes blurred vision
Causes	•Eyeball is too long •Cornea has too much curvature	•Eyeball is small •Lens is weak	•Irregular shape of cornea •Uneven curvature of lens
Site of light focus	In front of the retina	Behind the Retina	_____
Corrected by	•Biconcave lenses (minus) •Flattened cornea by surgery	Biconvex lenses (plus)	Cylindrical lenses
Test	Snellen's chart (test for far vision)	Jaeger's Chart (test for near vision)	Astigmatism Chart

Accommodation

The process by which the refractive power of the lens is increased by increasing the curvature of the anterior surface of the lens for viewing near obje

1- Determination of Near point

Near Point: the distance from the eye to the nearest object that can be focused clearly

Equipment: Common pin

- The near point of vision increases with age leading to loss of elasticity of lens & weakening of cilliary muscles which control lens focusing: (**presbyopia**).

AGE	NEAR POINT
10 YEARS	8 cm
20 YEARS	10 cm
30 YEARS	12.5 cm
40 YEARS	18 cm
50 YEARS	40 cm
60 YEARS	83 cm
70 YEARS	100 cm

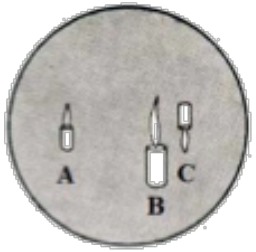
2- Accommodation Test

-Accomadation can be tested by observing **Purkunje-Sanson images** in a dark room.

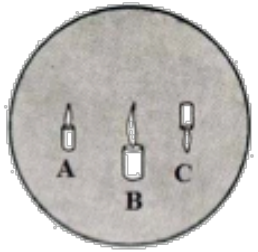
-Equipment: A candle and a dark room

-If a small bright light, usually a candle, is held in front of and a little to one side of the eye in a very dark room, three images are seen:

Image	Comes from	Properties
First image (A)	cornea	Small – bright - upright
Second image (B)	Anterior surface of lens	Large – less bright - upright
Third image (C)	Posterior surface of lens	Small – bright - inverted



Before Accommodation



After Accommodation

During accommodation, the second image comes closer to the first image and also becomes smaller than when the eye was at rest. "Because lens become more convex"

Color Vision

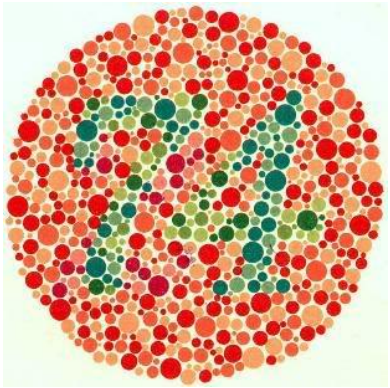
Is the function of the **cones**.

There are three types of cones in our eyes; **red**, **green** and **blue**. Relative lack or deficiency of one, two or all of them will lead to a defect in color vision.

Color Vision Test

✓Ishihara's Plates are made up of coloured numbers or spots on a background of identical shaped colored spots.
✓The figures or numbers are intentionally made up of colors that are likely to look the same as the background to an individual who is color blind.

Equipment: Ishihara's Coloured Plates

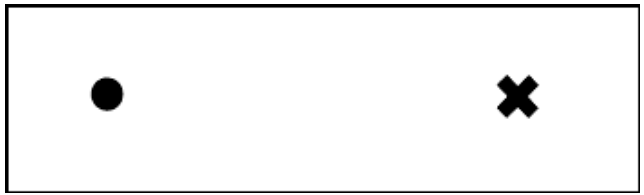


TYPE OF COLOR BLINDNESS	DEFINITION & PATHOLOGY
PROTANOPIA (RED BLINDNESS)	A form of colorblindness characterized by defective perception of red and confusion of red with green or bluish green due to the complete absence of red cones.
DEUTERANOPIA (GREEN BLINDNESS)	A form of colorblindness characterized by insensitivity to green, moderately affecting red–green hue discrimination due to the complete absence of green cones.
TRITANOPIA (BLUE BLINDNESS)	A very rare visual defect characterized by the inability to differentiate between blue and yellow due to the complete absence of blue cones.
PROTANOMALY	A type of anomalous trichromatic vision with defective perception of red due to less sensitivity of red cones.
DEUTERANOMALY	A type of anomalous trichromatic vision in which the green cones have decreased sensitivity, mildly affecting red–green hue discrimination.
TRITANOMALY	A rare type of anomalous trichromatic vision in which the blue cones have decreased sensitivity, affecting blue–yellow hue discrimination.

Demonstration of Blind Spot

Blind spot (scotoma): the place in the visual field where an object cannot be seen keeping one eye closed.

- This is due to the light rays from that part of the visual field focus on the optic disc of the retina, which lacks the light-detecting photoreceptor cells. Which the optic nerve and blood vessels pass.
- The optic disc of the retina is located medial to fovea centralis (means blind spot is lateral to visual field)
- We don't perceived the blind spot because: we have two eyes. Which each one will cancel the blind spot for other eye.



Equipment: Blind spot card

THANK YOU FOR CHECKING OUR WORK!

BEST OF LUCK

WE ARE ALMOST

CNS-BLOCK-FREE

Done By:

- ★ Hussain AL-Kaff
- ★ Lamya Althawadi
- ★ Amal Afrah
- ★ Nouf Almasoud